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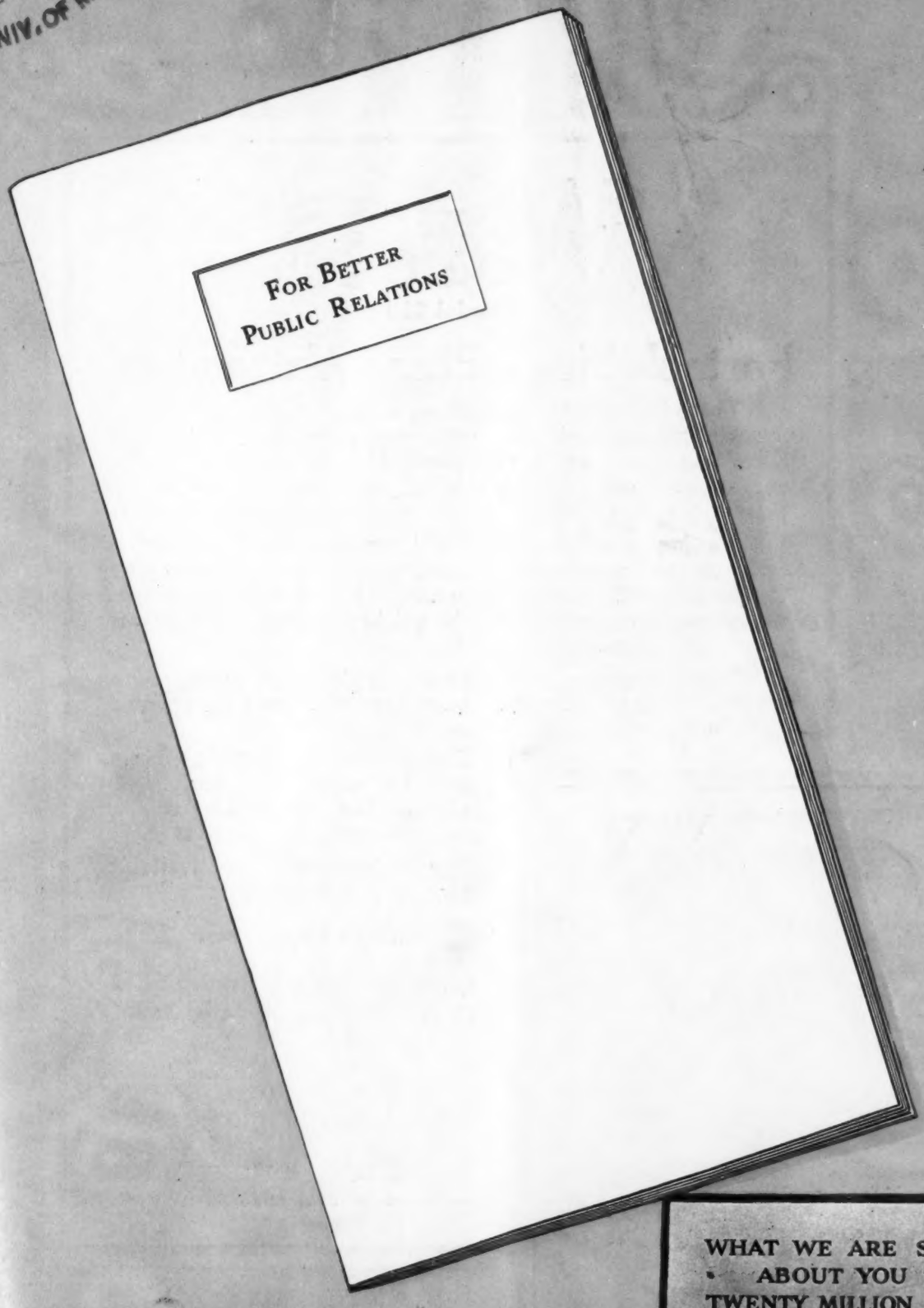

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S. B. WILLIAMS, Assistant Managing Editor A. M. PERRY, Engineering Editor J. C. MARTIN, Western Editor ROBERT SIBLEY, Pacific Coast Editor H. S. KNOWLTON, New England Editor

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Tax-Exempt Utility Bonds

THE president of the Chicago Telephone Company suggests in all seriousness that public utility bonds be placed on a parity with municipal and other governmental obligations so far as exemption from taxation is concerned. The plea offered is that the utilities render a public service like municipalities and that if the bonds were tax exempt reductions in rates would ensue. There is no doubt that such exemption would add materially to the attractiveness of all railroad, railway, gas, water and electric securities, but we doubt whether the suggestion will receive consideration. There is a feeling already in existence that the list of tax-free securities is too large as things are.

Higher Rates Necessary

THE Federal Reserve banks are offering Treasury certificates of indebtedness for $150,000,000. The certificates will be exempt both as to principal and interest from all taxation now or hereafter imposed by the United States or any state or possession of the United States and from any local tax, and they will yield interest at the rate of 6 per cent per annum. We cite this as an instance of the high cost of money to the government and offer it as justification for higher rates of return to public utilities. Considering the tax-exempt features of the notes, the yield to the investor is more than 6 per cent, and yet public utilities are expected to make extensions on borrowed money yielding 8 per cent or less. Of course the money cannot always be obtained. Only recently a leading Illinois utility offered $10,000,000 worth of three-year 7 per cent notes, and five leading Chicago bankers jointly bid 94½ for the issue, or a yield basis of almost 9 per cent. This was considered prohibitive public utility credit, and the company withdrew the issue and the needed improvements were not made. Thus, unless higher rates are forthcoming to justify earnings which will procure money in an abnormally high market, utilities are punished, but only at the expense of the general public.

Massing Engineering Society Influence

IN THE two months that have elapsed since the Federated American Engineering Societies was so auspiciously ushered into being at Washington, D. C., much has been accomplished toward the completion of its organization plans. The four founder societies have taken favorable action and are now considering definite procedure for completing their affiliation. Invitations have been sent to some 150 national, regional, state and local engineering bodies to become charter members. It is now the obligation of every engineer who is a member of any one or more of such organizations to familiarize himself with the work of the new federation, as outlined in detail in the issue of the ELECTRICAL WORLD for June 12, pages 1359 to 1364. No movement in the history of engineering organizations has been so far-reaching and no previous opportunity has come to engineers as a body to make their influence a real power in national affairs and the work in which engineers are themselves vitally interested as individuals. It makes possible group action on matters heretofore taken up by individual societies and co-ordinates the efforts of all engineers on matters of common interest. This influence among others that the new body will exert should compel prompt consideration of membership applications by the many small as well as the larger organized groups of engineers. Indifference in this matter will not be in accord with the kind of thinking that is generally credited to the engineer, for this is the fitting opportunity for him to establish himself and his profession in national as well as local engineering affairs.

Qualifications of Engineering Teachers

FROM the growing discussion of how to obtain and retain competent instructors in the technical colleges against the competition of the industrial interests, and in the face of the fact that stipends all too meager in 1914 mean actual privation in 1920, a few notes sound clearly. One of these is that the competent engineering teacher, or, rather, teaching engineer, must have had practical experience which he can translate into instruction. The days when a newly robed graduate could step from the scholar's bench to the schoolmaster's rostrum with no further qualification than mastery of textbook theory have been swept into the past.

Faith in Regulation Justified

THE railroads of the country have set an example of patience and forbearance which is worthy of emulation. Harassed by low rates, high costs and labor difficulties innumerable, not to mention government ownership, they have steadfastly maintained their faith in American interests and principles. Did the proper authorities award high wages, the verdict was accepted and labor paid. Were freight embargoes promulgated, the orders were scrupulously observed. Any and every edict, though it plunged the railroads deeper into the slough of economic despair, was carried out. Even the Interstate Commerce Commission, which was presumed to serve as a bulwark between the railroads and the public, for years treated the roads in a niggardly fashion. Nevertheless, they kept right on. Undernourishment, however, had its effect, and when at length the railroads appeared, weak and emaciated, before the Interstate Commerce Commission and asked for help that august body perceived the serious consequences of its lack of action and straightway granted relief to the tune of $1,500,000,000. The whole episode should strengthen

the faith of every public utility in commission regulation. Some will claim that the award to the railroads was rather belated, but the main fact is that the award came, and this in itself is a triumph for regulation.

Transoceanic Telephony

JULY, 1920, was marked by two important developments in radio-telephony (reported in our issue for July 31) which have an important bearing upon the final goal of radio engineers, the transmission of speech across the oceans. While speech has been transmitted from Washington to Honolulu and from New Brunswick, N. J., to France previously, the problem of extending as rapidly as possible the radius of speech by the use of commercial apparatus is being still further investigated, and it is said upon good authority, although complete details are lacking, that the St. John's demonstrations of the Marconi engineers were a step nearer to the use of commercial apparatus for such service. It should be borne in mind, moreover, that success at 600 miles (950 km.) in the summer time may easily be equal to 1,000 miles (1,600 km.) in the winter time, when atmospheric electricity offers much less disturbing influence. Moreover, in extending its telephone service across the water, even a distance of 30 miles (48 km.) to the Catalina Islands, without intervening wires, the American Telephone & Telepraph Company has established what is believed to be the finest commercial service of this sort. One may conceive of the huge Bell system gradually reaching out into the waters to establish regular telephonic communication between this country, its insular territory near the coast and even across the seas, and boats leaving and entering American ports. To establish communication where wires cannot readily be installed is, of course, pre-eminently the future field for radio-telephony. Commercial service of this nature has now begun.

The Strategy of Interconnection

WHEN interconnection has to be effected as part of an effort to keep down costs by those who are trying to run a system for operating profit against rising expenses, the treatment of the situation requires finesse. It is such a case that we consider this week—the gathering into a coherent system of a group of small towns and cities in the rich farming country of Indiana, facing the need of rigid economy by reason of the scattered service. Our readers will find the story particularly instructive because of its dealing with costs. The places served were in two groups quite apart, and to reap the advantages of interconnection it was necessary to erect about 125 miles (200 km.) of transmission line. Some useful economies were introduced by rebuilding 6,600-volt lines to accommodate 33,000 volts, while the main link was a new line of the latter voltage.

This line was built on a strikingly economical basis and has given good service. It consists of 30-ft. (9-m.) cedar poles with 6-in. and 7-in. (15-cm. and 17.5-cm.) tops, butts treated, and spaced at about 130 ft. (39 m.). Metallic cross-arms were mounted on these, carrying 45,000-volt pin-type insulators. The construction is light, but heavy enough for the No. 6 medium-hard-drawn conductors used. The remarkable feature of the case is that even in these expensive times this line was built for a shade under $2,000 a mile for labor and material. Including some reconstructed 6,000-volt line, right-of-way and even substations, the 33,000-volt line barely turned $2,500 per mile.

At one end an old plant was rehabilitated and put in shape for emergency service by installing a new boiler unit and feed-water heater, lagging steam pipes and putting engines in first-class condition. This was done without breaking service in the absence of transmitted power, though the task proved to be a strenuous one.

Incidentally a most efficient job was done in the erection of two substations of the outdoor kind, each rated at 600 kva. in three units. One of these is equipped with electrolytic lightning arresters, while the other involved the extra expense of a pair of induction regulators. The first of these substations cost ready to run about $15.50 per kva., the second only $13.15. There is a lesson for many a group of small properties in the care and ingenuity by which an efficient rehabilitated system was put into operation at a singularly low cost. A struggle to achieve results of this sort costs in resourcefulness and thought more than many a pretentious network, and it is such a struggle that comes in the adverse conditions that surround scores of small undertakings.

Fuel-Oil Atomization

DISCUSSION is in progress among some central-station operators as to the advisability of a change-over from coal as fuel to the use of fuel oil or crude petroleum. Owing to the necessity for ever-increasing power plant capacity, attention must of course be given to the particular type of atomizer to be used in spraying the oil into the furnace in order to bring about the most efficient combustion and at the same time develop the furnace capacity to a maximum. In general, three different methods of atomization are now in common practice. One method is to spray the oil into the furnace by means of steam, while a second method involves the use of compressed air, and the third makes use of some mechanical device to accomplish atomization.

In essential features the mechanical atomizer burner consists of a nozzle containing a conical-shaped orifice through which the oil is forced at high pressure, the oil being first heated to a temperature approaching its flash point, while within the nozzle means are provided to give the oil a whirling motion of sufficient intensity to make it fly into a spray on account of the centrifugal force as soon as it leaves the nozzle.

In practically all of the large central-station plants on the Pacific Coast, where the use of fuel oil has been developed to a remarkably high degree of efficiency, atomization by steam is in use. From 2 to 4 per cent of the steam generated is blown into the furnace to accomplish this result. Hitherto mechanical atomization has found its greatest application aboard ship, where it has proved unusually effective. It would appear, however, that certain definite advantages in the increasing of furnace capacity by means of mechanical atomization should lead those contemplating a change-over from coal to fuel-oil-burning plants to give careful consideration to the type of atomizer that is to be used.

The Vision of the West

FROM the East to the West over the trails of the miner of '49, now obscured by modern means of transportation, go annually thousands of sightseers, a mixed group of nature lovers, business men, opportunity seekers and the like, each with a home-made impression of Western industry and the social life and customs of those who have created it. The influence of prose and verse and the tales of those who have returned have frequently made scoffers and unbelievers. The knocker, however, finds life uncongenial in the West. Somebody is sure to tell him that the mule makes no progress while he is kicking, or he will be shown some work of the human brain and hand that, except through the evidence of the eye, would seem utterly beyond the range of economical possibility.

Good roads and the automobile have done much to reveal the true vision of the Western pioneers, for transportation by this means makes it possible for those interested in things electrical, when visiting the large water-power developments of the High Sierras and following the 240 miles of 150,000-volt transmission circuits into the city of Los Angeles, to pass through the huge tropical fruit gardens of central California. The large annual returns from these so-called gardens or fruit ranches are the demonstration that the difference between the barren dessert and production at $500 to $1,000 per acre is water and that the most economical agency for its distribution is the motor-driven pump.

Persistence coupled with ingenuity may be observed this year, with a precipitation and run-off far below normal and coal unobtainable, in applications of oil and gas in the southern coast section and powdered fuel and hogged fuel in the northern section in order to insure a continuity of electric service. Furthermore, though capital from financial centers of the East has been insufficient, construction can be observed supported by local funds, and plans for future work that will substitute fleets of bombing planes for motor trucks or temporary railroads in the delivery of construction material and machinery to new water-power sites over the precipitous Sierras. Here the obstacle not only of time but of money for road building to the extent of $4,000 to $6,000 per mile is being overcome.

Again, in the West, where long transmission lines and high voltage are synonymous, the application of 220,000 volts may be observed as an economic necessity because of savings that total for one long line something like the ten million dollars which a duplication of present construction would require. On the Kern River may be seen a new arrangement to serve two systems, one of 50 cycles and the other of 60 cycles, by the use of two waterwheels driving the same generator but having different speeds. Across practically the entire length of three of the Northwestern states stretches a practical demonstration of steam-railroad electrification that in economy of operation and efficiency of service has surpassed the fondest dreams of the original promoters. Opportunities for industrial development also ordinarily unassociated with the Pacific Coast are springing up in the great Northwest, which, when stimulated by proper publicity regarding the natural resources and facilities of that territory, will enable even greater utilization of potential water powers than exists at the present time. Easterners too frequently have the impression that the Westerner is addicted to ridiculous bragging concerning the future of his section, but this is unfair. He who glories in the building of congested industrial centers in the East cannot view the opportunities of the West and the future that is yet to be built without being filled with admiration for American initiative and accomplishment, be it West or East, and for the constitution which makes these sections one.

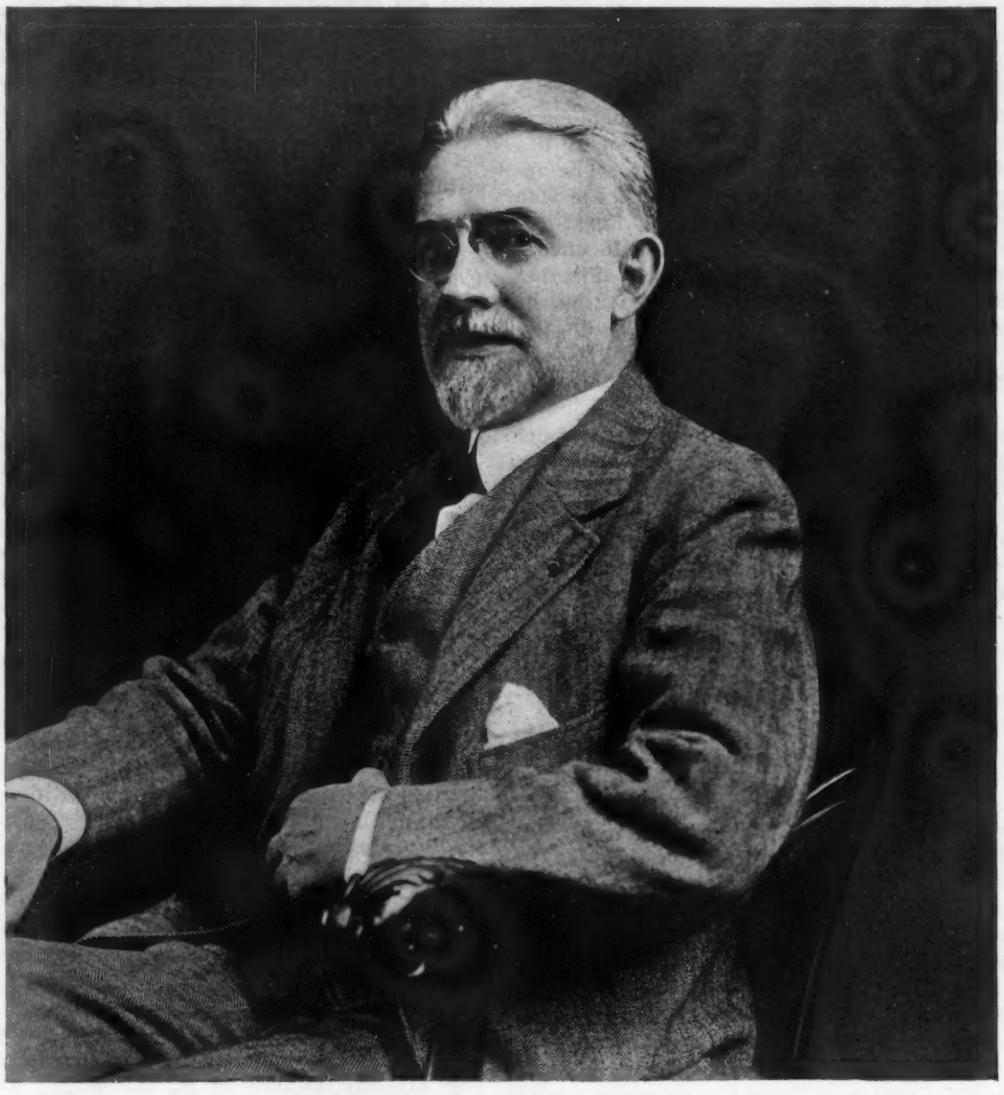
Cooling Transformer Vaults

THERE is a temperature, determined by the nature of the insulation, beyond which a transformer cannot safely be worked. Under load a certain stable temperature is attained, depending on the copper and iron losses and on the facilities for getting rid of the heat thus generated. Since the cooling of air-cooled transformers depends on the temperature difference between the cooling surface and the surrounding air, the exchange of this air largely determines the final results. Some light is thrown on this subject of ventilation by W. W. Parker in our columns this week.

In theory, ventilation is the exact inverse of electric heating, but in practice this is not the easiest way of getting results for a transformer vault. The value of Mr. Parker's experiments lies in the empirical but very convenient data obtained from a variety of existing vaults under working conditions. As a matter of experience a rise of 15 deg. C. of the air above the rated working temperature of the transformer is about all that is safe even for full loads over a rather limited time, and under average conditions Mr. Parker finds that to keep within limits 75 cu.ft. to 100 cu.ft. of air per kilowatt of transformer loss must be removed from the inclosure per minute.

This must practically be done by natural draft either by general circulation or by a chimney of height and capacity enough to do the work. The data obtained and tabulated give the required information to the engineer. The exposure of the vault with respect to prevailing summer winds is in some cases a not unimportant factor.

The solution of a concrete problem is given in some detail both with and without a deliberately planned chimney, which seems on the whole the best method of insuring really good and reliable ventilation. Such a chimney can be figured much in the ordinary way, though the height is generally small. The data given in the tables pertain to fairly sizable installations ranging from 225 kw. to 1,600 kw., such as are usually to be found in vaults. In smaller examples the loss of heat through the walls would usually be proportionately greater and hence the ventilation required a simple matter. A practical hint is given respecting the avoidance of moisture. This requires that no part of the installation shall be permitted at any stage of operations to be below the temperature of the external air. Where a switchroom is separate from the transformer inclosure there is some risk of this, and hence there should be sufficient ventilation between the two inclosures to keep the temperature above the effective dew point.



Henry Latham Doherty

Engineer, financier, utility manager, rate expert, and healer of sick public service corporations

ALWAYS seeking new problems to solve and solving them, H. L. Doherty has forced his way up through the ranks until he is now at the head of one of the largest public utility holding companies in the United States, the Cities Service Company, with properties situated in more than half the states. He was a newsboy in Columbus, Ohio, when at the age of twelve he entered the utility field as an office boy with the Columbus Gas Company. As a result of hard work and hard study he advanced rapidly in the engineering department and at the age of twenty-two became chief engineer and assistant to the manager of the Columbus plant. His work attracted attention, and when shortly afterward the Madison (Wis.) Gas & Electric Company needed some one to put it back on its feet young Doherty was chosen. What he did at Madison he duplicated at many other places in the next few years until he became widely known as a healer of sick utilities. All this time he had been working for others. At the age of thirty-four, however, he broke loose and began to acquire one after another "sick" utility which he reorganized and put back on a dividend-paying basis. From this beginning grew up his large public utility business, to which in more recent years he has attached an oil business of very large proportions.

Wherever Mr. Doherty has taken hold he has left an enduring impression. This is just as true of association work that he has undertaken as it is of his utilities. He guided the Society for Electrical Development from its beginning until a year or so ago. He has been Jupiter of the Jovian Order and in 1901 was elected president of the National Electric Light Association, the first of a long line of young men to hold that office. When he took office the N. E. L. A. was largely an engineering body. He saw the need for covering all utility work, and at his suggestion its program was broadened to include commercial and accounting activities.

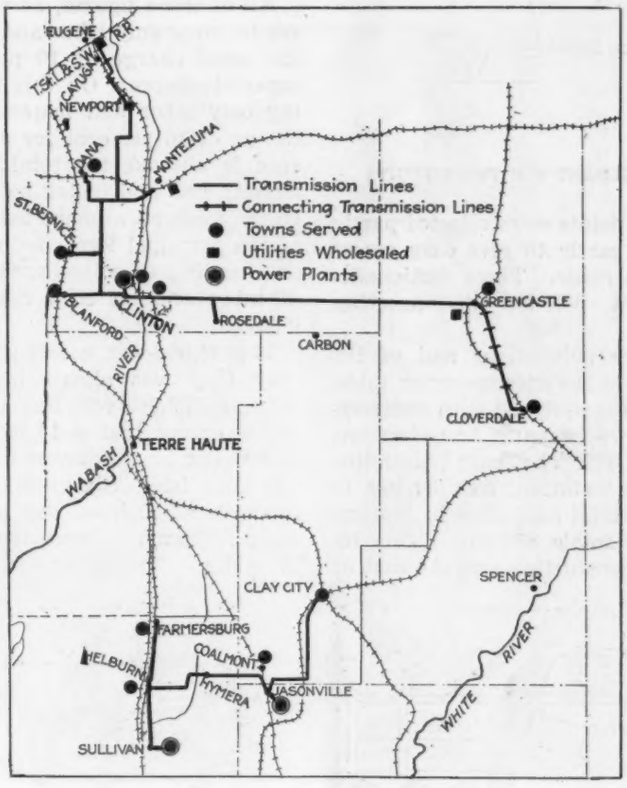
To his early method of self-education, in pursuit of which whenever he witnessed an engineering operation new to him he would study out its theory at night, the industry owes the "cadet-school" system. Following his lead other utility organizations are similarly training their future executives. In 1900 he proposed his "three-charge rate," now generally known by his name, doing much to popularize the "readiness-to-serve charge" in rate schedules.

Mr. Doherty celebrated his fiftieth birthday on May 15. His employees marked this occasion in a most fitting manner by planting a Doherty tree at each Doherty property, there to stand through the years to come as a tribute to their chief.

Interconnecting Small Cities

Data on the Costs of Present-Day Line Construction, Together with Methods of Emergency Operation, Collected from Indiana Central-Station Companies Serving Twenty-one Communities in the Hoosier State

TWENTY-ONE communities in south central Indiana ranging in size from 200 to 20,000 inhabitants are served by the Wabash Valley Electric Company and the Putnam Electric Company. Between the cities served, which are in two groups, about 125 miles (200 km.) of transmission line has been erected. The general idea pursued by the present management has been typical of the progressive tendency toward interconnection that has been necessary throughout the Middle West in order to shut down inefficient generating plants. The company's more recent experience has included construction of some new lines to operate at 33,000 volts and others to operate at 11,000 volts and the reconstruction of 6,600-volt lines to operate at 33,000 volts. This experience is of particular interest, not only because it represents present-day costs but because it shows how use is made of a rather lighter type of 33,000-volt construction that can be employed to handle comparatively light loads. The over-all average cost of the 33,000-volt construction and the reconstruction of the 6,600-volt lines, including right-of-way and substations, was about $2,510 per mile. The 33,000-volt construction cost about $1,967 per mile for labor and material.



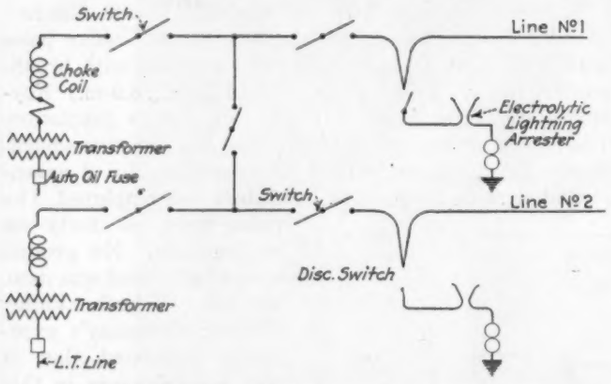
LAYOUT OF SYSTEM INTERCONNECTED

More specific information can be brought out by relating the story of two typical lines—one a 33,000-volt line from Clinton to Greencastle and the other an 11,000-volt line from Jasonville to Clay City. The need for the Clinton-Greencastle line became apparent when the company bought the Greencastle generating plant and found that to produce electricity there was very expensive. A possible solution of this difficulty lay in the building of a new plant or in the building of a transmission line over the 32 miles (51 km.) between the two cities. Over a part of the distance a 6,600-volt line was already operating from Clinton to Rosedale. It was decided to rebuild this line to operate at 33,000 volts and to use it as a part of the Clinton-Greencastle line. It was also decided to rehabilitate the Greencastle plant so that it would be available for emergency service at the end of the 32-mile (51-km.) line. The vicinity of this line also promises additional mining and small-town load.

The new construction for the 33,000-volt Clinton-Greencastle line consisted of 30-ft. (9-m.) cedar poles with 6-in. (15-cm.) and 7-in. (18-cm.) tops with brush-treated butts. These poles carried 3-ft. (6.9-m.) Keystone arms and 45,000-volt pin-type Locke insulators. The conductor for the main line was No. 6 medium hard-drawn solid copper wire. At crossings No. 2 seven-strand wire on suspension insulators was employed. The poles were set forty-one to the mile. No ground wire of any kind was used, as the Wabash Valley Electric Company's experience indicated that it was not necessary in this territory. Where new construction was required this sort of wood-pole line was erected along the right-of-way that was partly private and partly followed the highways of the country. Between Rosedale and Clinton, however, where a 6,600-volt, single-phase line had been in operation on an ordinary wooden two-pin arm, this construction was utilized partly in changing over to 33,000-volt operations. These two-pin arms were dropped and fastened to the poles at a lower point temporarily while the linemen put the metal Keystone arms on the tops of the poles. With both sets of arms on the poles the third wire was strung and tied in on the pole pin and then the two wires of the 6,600-volt line were moved up to the outer pin on the Keystone arm. This change-over was accomplished with the 6,600-volt line in operation.

The substations along the line are mostly of standard delta-star construction. At Clinton the substation consists of two banks of transformers stepping up the energy from 2,200 volts to 33,000 volts. One of these banks of transformers is rated at 600 kva. and the other at 375 kva. This substation is laid out so that either bank of transformers can be switched to either of the outgoing lines. At Lyford two 25-kva. transformers operating in open delta are used to step down the potentials from 33,000 volts to 2,300 volts for town lighting. This is an ordinary wood-pole substation. At the nearest point on the transmission line, Rosedale, another wood-pole substation, mounting a 50-kva., single-phase, 33,000-2,300-volt transformer, is used for transmitting energy at 2,200 volts 2 miles (3-km.) to the town for lighting. The substation at Greencastle consists of

three 200-kva., 33,000-2,300-volt transformers arranged for parellel operation in an emergency with the 600 kw. of generators in the power house. Along the Greencastle line three sectionalizing points have been erected at distances of about 10 miles (16 km.) apart. The loca-



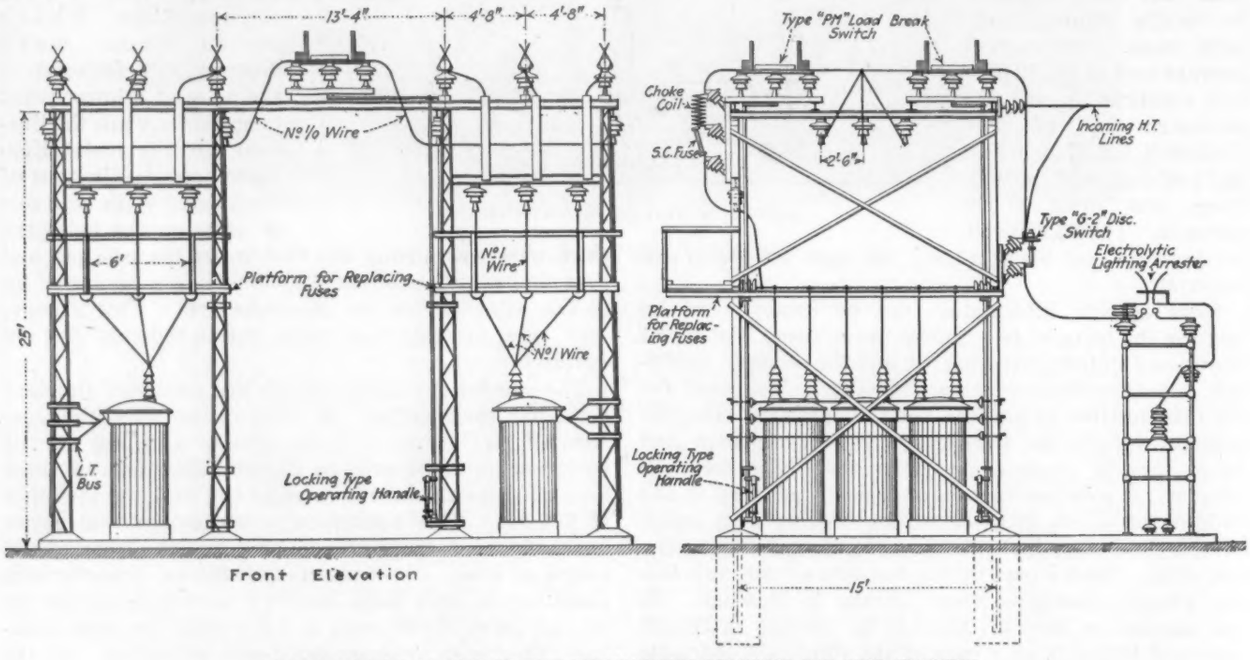
FLEXIBLE SWITCHING ARRANGEMENT FOR TWO CIRCUITS

tions for these sectionalizing points were selected partly to obtain equal spacing and partly to give easy access to them from the automobile roads. These sectionalizing points mount standard pole-top disconnecting switches.

The costs of these various substations and of the transmission lines are shown in the accompanying table. The Clinton substation, which is equipped with electrolytic lightning arresters and two banks of transformers, cost for labor and material $9,329. The short branch line to Rosedale, including the substation, cost $1,469 to rebuild. The cost of the material and labor in the line from Clinton to Greencastle totals $53,807. This includes both the cost of new constuction and the cost of changing over the 6,600-volt line for 33,000-volt operation. It had been the intention to segregate the cost of the new line from the cost of the rebuilt line, but owing to the way the work was done it was found that this was a virtual impossibility. The company has estimated, however, that the cost of rebuilding the line from Clinton to Rosedale Junction was approximately $5,600 for labor and material. This was a distance of 7 miles (11 km.), showing the cost per mile of labor and material for rebuilding to be approximately $800. This would leave the remainder of the $53,807 to be charged to the new construction; therefore the cost of the new construction would be $53,807 minus the $5,600, or $48,207. Since the poles on this line were set forty-one to the mile, and since 1,002 poles were used, this would indicate that the line is approximately 24½ miles (40 km.) long, and figuring on this basis the cost of the labor and material for the new construction would be $1,967 per mile.

All of these figures, as well as the data in the table, are to cover only labor and material and do not include the usual charge of 10 per cent for engineering and superintendence. On this basis the entire job, including only labor and material, cost $73,018, and if the charge of 10 per cent for engineering and superintendence is allowed, the total cost of building the transmission line and installing the substation was $80,320. In the table an attempt has been given to list the costs of the principal items individually and to group under the heading of miscellaneous all of the smaller items of labor and material expense that were necessarily incurred.

The 11,000-volt construction between Jasonville and Clay City was almost identical in its specifications with the 33,000-volt line between Clinton and Greencastle, except that a 15,000-volt insulator instead of a 45,000-volt insulator was used. This line was 12 miles (19 km.) long. Six miles (10 km.) of it was built on the railroad right-of-way and the remainder was built along highways between the two towns. To have hauled the poles on trucks or wagons to their respective loca-

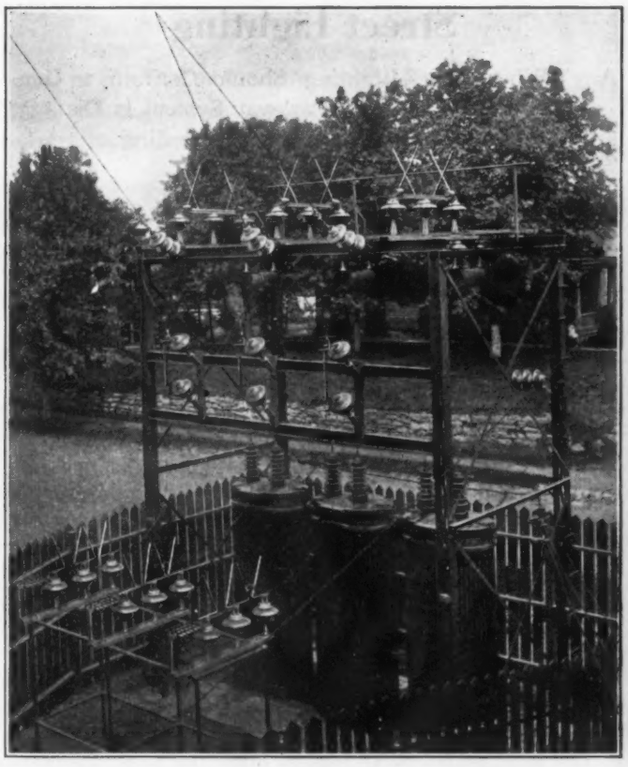


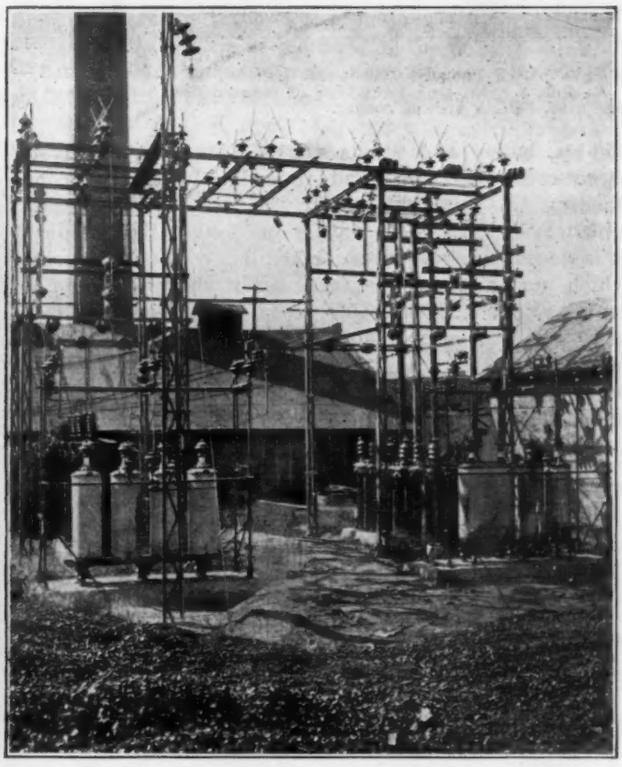
CROSS-SECTION OF ONE OF THE SUBSTATIONS DESIGNED FOR TWO CIRCUITS

tions along the railroad right-of-way would have been expensive in this case, on account of the fact that the poles would have had to be skidded to their location by teams operating either across very rough country or on an almost impassable railroad right-of-way. To obviate

this difficulty the company hired a locomotive and a couple of railroad flat cars from the railroad company and distributed the poles along the track at approximate locations and later piked them into the holes. The price charged for the use of the railroad equipment was reasonable, and the saving which the use of it effected was considerable. The cost of this line was $1,400 per mile, without transformers, and the use of the railroad equipment partly accounts for this low cost.

While the experience with the 33,000-volt construction described here has not been of especially long duration, the line had withstood the greater part of one winter's operation before this comment was prepared. Until that time one patrolman and one helper operating in a Ford car had been able successfully to take care of the Clinton-Greencastle line and enough of the other lines in the company's northern territory to make the total mileage of line cared for by this crew about 75 miles (120 km.). They carry in the car a set of Johnson high-tension tools and get over the entire line about once a week. The main trouble has come from insulators which are shot by hunters. However, in spite of this annoyance the service on the line has been considered quite satisfactory.





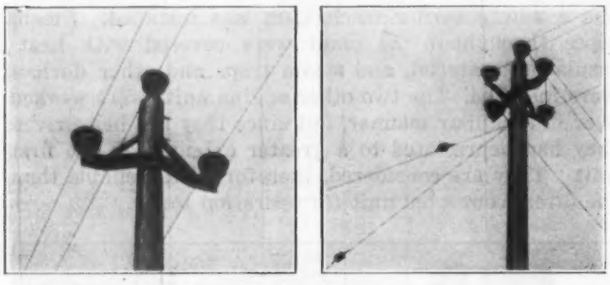
DOUBLE-CIRCUIT SUBSTATION AT CLINTON; 600-KW. STATION REPLACES STEAM PLANT

Part of this success may be attributed to the rapid emergency service which it is possible to give the city of Greencastle from the rehabilitated power plant there. When this plant was purchased it was in very poor condition, and it is still very expensive to operate. It will, however, give service in an emergency. When the plant was purchased the overhauling processes were started in the boiler room, where a 250-hp. return tubular boiler and two 150-hp. water-tube boilers were retubed and reset. In addition to this the company installed one new 150-hp. fire-tube boiler. These are all hand-fired units. A new feed-water heater was installed to replace an old one that had been made out of a discarded condenser. The old heater was found to be entirely clogged with scale. In the engine room there are three engine-driven units. One, rated at 250 kw., is direct-connected. The two others are belted units, rated at 250 kw. and 150 kw. respectively. On the direct-connected 250-kw. unit all bearings were renewed and a new governor mechanism was installed. Steam pipes throughout the plant were covered with heat-insulating material, and steam traps and other devices were installed. The two other engine units were worked over in a similar manner, but since they are belt-driven they had depreciated to a greater extent than the first unit. They are considered, therefore, less reliable than the direct-connected unit for operation today.

During this reconstruction period in the engine room service was maintained from this plant without the assistance of the transmission line. The story of the methods used in maintaining service while this rebuilding was in progress is almost romantic. There were times when the combination operating and construction crews found it necessary to operate the plant with one man at the engine throttle and another at the switchboard because the governor mechanism on the only engine available for service was out of commission. However, by persistent effort, which was often continuous throughout twenty-four hours of the day, these men succeeded in maintaining service for the city, not only while the boiler room and the engine room were rebuilt but also while the switchboard was moved from one location to another.

The present method of operation in normal times is to supply the city of Greencastle with energy received over the transmission lines of Clinton at 33,000 volts. In an emergency, however, one 250-hp. boiler which carries 100 lb. (7 kg. per sq.cm.) of steam all of the

time can be placed on the line and can pick up the load in from three to five minutes. An engineer who is regularly employed by the company lives directly across the street from the power plant, and he is able to get the Greencastle plant on the line without help. When an emergency is to be met he throws the draft on this



33,000-VOLT CONSTRUCTION, COSTING ABOUT $2,000 A MILE
A—Pole top showing light type of construction and absence of sky wire. B—A typical corner.

250-hp. boiler and starts the 250-kw. engine-driven, direct-connected unit, and immediately upon accomplishing this puts fire under the new 150-hp. boiler, which is kept ready for firing but is not lighted until it is needed. This boiler always has coal on the grate which can be fired by carrying a few shovelfulls of live coals from the 250-hp. boiler. By the time the load begins to drag heavily on the 250-hp. boiler the 150-hp. boiler is usually ready to give some help. The 150-hp. boiler can be placed under full steam in about one hour under favorable conditions. When both of these boilers

TRANSMISSION LINE COSTS IN INDIANA (UNDER CONDITIONS IN SUMMER AND FALL OF 1919)

Clinton Substation:		
Lightning arresters	$1,293	
Tower and high-tension equipment	2,171	
Transformers, three 200-kva	4,417	
Miscellaneous material and labor	1,446	
		$9,327
Branch line to Rosedale transmission line, 2 miles	$355	
Rosedale 50-kw. substation	1,114	
		$1,469
Clinton-Greencastle Line:		
Right-of-way	$2,422	
Conductor and guy wire	9,912	
1,002 poles	7,306	
1,264 cross-arms	3,226	
4,253 insulators	8,706	
4,570 pins and bolts	2,379	
Three air-brake switches	447	
324 anchors	622	
Auto repairs, operation and tires	1,784	
Bond interest during construction	1,105	
Insurance	998	
Freight, drayage and express	1,539	
Labor	12,150	
Miscellaneous expense	1,211	
		$53,807
Greencastle Substation:		
Two 34.5-kw. induction regulators	$2,300	
One outdoor substation	874	
Three 200-kva. transformers	4,207	
Freight and drayage	222	
Miscellaneous expense	269	
		$7,872
Substation equipment at Lyford		543
Total cost of labor and material		$73,018
10 per cent engineering superintendence		7,302
Grand total		$80,320

are in operation it is possible to operate one of the 250-kw. generators and the 150-kw. generator if necessary, but it is usually found that a 250-kw. unit will carry the load.

The cost of this emergency service is about one ton of coal a day. Accidental interruption to service has been experienced only about once every two months, but the Greencastle plant is operated on the average about once every ten days or two weeks, because it is needed to help out the Clinton plant when boiler cleaning or repair work is necessary there. It is believed that after the transmission line has weathered the first winter interruptions will be less frequent.

The construction and rebuilding on these properties were carried out under the direction of their operating management, which consists of C. M. Poor, vice-president and manager of the Wabash Valley Electric Company, Clinton, and C. W. Otis, local manager of the Putnam Electric Company, Greencastle, Ind.

Tendencies in Ornamental Street Lighting

Any "White-Way" Lighting Should Conform to General City Plan—The Parkway System Is Discussed and Suggestions Regarding Installation Are Made

BY L. A. S. WOOD
Manager Illuminating Section Westinghouse Electric & Manufacturing Company

AN ORNAMENTAL street-lighting system should be considered as part of a scheme for beautifying the city as a whole and not as a means of advertising one section of a city perhaps to the detriment of some other locality. In recent years, moreover, the intensity of illumination on city streets has been materially increased and the necessity for brilliant lighting or "white ways" in individual localities has disappeared. An appreciation of this condition will help in solving the problems in connection with ornamental street lighting because it opens the way to the proper financing of the installation and the maintenance of the system when completed.

The cost of the installation of an ornamental street-lighting system might very well be borne by the property owners on the street where the ornamental system is to be installed, but the maintenance of such a system should be borne by the city as a whole.

The most satisfactory way of financing an ornamental street-lighting system is for an improvement district to be created and the adjacent property owners assessed on a front-foot basis in the same way as they would be assessed for any other municipal improvement. In general the expense to the property owner for the complete installation under a scheme of this character is very low, usually not more than $1.50 per front foot, while the cost to the individual citizen for maintenance of the improved system from which he receives material benefit is negligible.

It is thought that the central station should discourage the indiscriminate installation of ornamental posts outside business premises, and all suggestions for "white ways" should be the subject of careful consideration and consultation with the city authorities before the central station takes an active part in their promotion. "White ways" should always be considered in connection with the "city beautiful" idea and in the light of ornamental systems benefiting the city as a whole rather than as a means of advertising some particular locality.

The manufacturers of ornamental street-lighting devices may with advantage be consulted, and their

suggestions may well have very serious consideration before any ornamental system is designed, for some of the manufacturers of this class of apparatus have collected valuable data on the subject which is at the service of any city interested.

The central station is particularly interested in the maintenance of ornamental lighting systems, and from the central station standpoint as well as from the city's a series system is usually the best to adopt. If lamp renewals are covered by the maintenance contract the central station will find that the moving-coil regulating transformer will give the best results owing to its perfect regulation under all conditions. The ease with which a series system may be controlled and extended renders it particularly suitable from a central-station standpoint.

ADVANTAGES OF PARKWAY SCHEME OF DISTRIBUTION

There has been some difference in opinion as to the relative advantages of a conduit system versus "parkway" or steel-armored cable, but the general consensus of opinion is in favor of the latter. The argument in favor of the conduit system is the ease with which damaged cable may be withdrawn from the conduit, but if the installation is properly made this should not be necessary except in the unlikely event of the cable being subjected to mechanical injury, in which case the location of the fault is a comparatively easy matter.

Steel-armored, lead-covered cable should be laid in a shallow trench below the curb or in the "parkway," if there be any, and in this position it is not likely to be damaged. It is important that ends of the cable where cut should not be exposed to the weather or faults may readily be developed from moisture. All are familiar with the precautions taken by cable manufacturers to seal the ends of the cable before it leaves the factory, but unfortunately very little care is exercised in this direction when the cable is installed.

The best way to install armored cable is to lay it in a prepared trench, leaving a loop at the location of each post sufficiently long to reach the terminal of the disconnecting device in the base of the post, and to pour cement around the loop to form the foundation for the post.

This is a more satisfactory method than the usual one of making the post foundations first with the conduit elbows for the cable to be drawn through, as it leaves the cable intact until the time the connections are made in the base of the post.

A disconnecting pothead should be used in the base of the post, and this should be of such design as thoroughly to seal the ends of the steel-armored cable and efficiently bond and ground the steel armor and lead covers. It should also be designed so that the post wiring is automatically disconnected from the underground system and the circuit in the base of the post re-established by a short-circuiting device in the event of the post being accidentally broken. A device of this character was introduced about three years ago and has given very satisfactory results.

EFFECTIVE AND ORNAMENTAL STREET-LIGHTING UNITS RECENTLY ADOPTED AT SARATOGA SPRINGS, N. Y.

It is desirable that a device be used in the top of the post for relieving the terminals of the lamp socket from the strain of the weight of the cable used in wiring the post.

There is considerable difference of opinion among engineers as to the best type of glassware for street-lighting units, but the consensus of opinion is in favor of diffusing glassware for ornamental units owing to the practical elimination of glare with this type of glass. Glare within the range of vision of the pedestrian or vehicle driver should always be avoided.

Although during the war there were few developments in street-lighting units there has been great activity in this direction since, and we may look for many new devices in the near future which will materially assist efforts at making the "city beautiful" an accomplished fact in so far as the lighting of the streets is concerned. The possibilities of well-planned street lighting should be realized.

Considerations in the Burning of Fuel Oil

The Scarcity of This Fuel and the High Price of Other Fuels Make It Imperative to Give Greater Thought to Relative Economies of Oil and Coal, to Equipment and to Method of Operation than Has Ever Been Done

WITH oil becoming scarcer and scarcer and coal at a price undreamt of before the war it is worth while for every company to consider the relative economy of oil and coal in its plants and where oil is the answer to give more attention to the equipment required as well as to the best method of operating it. Even if oil does show a lower yearly expense than coal it would be unwise for any company to adopt it without considering that a greatly increased demand may make it almost impossible to obtain oil at any price. Furthermore, each company has to consider whether it is best situated to receive oil or coal shipments regularly. Limitations imposed by city ordinances on amount of oil storage also have an important bearing on the question of what fuel should be used.

As a basis for comparing the use of oil and coal the following points should be considered:

1. Oil fuel is cheaper per B.t.u. than coal in most parts of the United States.
2. Boiler room labor can be minimized.
3. Ash handling expense is eliminated.
4. Fires need not be banked and each fire is working at high efficiency.
5. Although both oil and coal may be purchased upon B.t.u. basis the tests involved in checking oil values are more easily and cheaply applied by the small companies.
6. Oil fuel can be burned more efficiently than coal.
7. Boiler rooms and surroundings can be kept neat and clean.

Assuming that fuel oil containing 18,500 B.t.u. per pound is available in competition with a high-grade coal testing 14,500 B.t.u. per pound, that the efficiency of the coal furnace is 60 per cent and that of the oil furnace 70 per cent, the theoretical equivalent for each long ton of coal would be 4.5 barrels of oil. Higher oil efficiencies than that assumed have been obtained, however, and if attainable in the average plant would materially reduce the ratio indicated.

The installation of oil-burning equipment in the ordinary plant is not very expensive. It is claimed by manufacturers of such apparatus that the saving in operating cost should pay for the changes in the average plant in two years. The burner in most common use for high-pressure work is of the steam-atomizing type. The steam projects the oil in a fan-shaped sheet of minute particles which extend from the burner mouth over the full width of the combustion chamber. Recently considerable thought has been given to the application of mechanical atomizers to stationary boilers because here is a possibility of forcing them to greater capacities than steam atomizers. Furthermore, such burners are said to make more effective utilization of furnace space.

One fireman can take care of ten oil-fired boilers, so that in large plants the decrease in labor required would be considerable. The cost of unloading coal, usually greater than that for oil, and the handling of ashes are eliminated. In the case of banked fires coal is being burned wastefully, whereas with oil-burning apparatus as soon as the load begins to decrease burners can be shut down or cut off entirely in any desired boiler or boilers and only enough fuel burned to maintain the load.

Since fuel oil is the residuum after the lighter and more inflammable oils have been distilled off it has a high flash point and can be handled with considerable safety. The flash point is usually above 170 deg. F. (76 deg. C.) (open-cup), and in the process of oil burning it is not necessary to raise the temperature of the oil above this point. The Mexican oil so extensively used in the Eastern states is a heavy dark-brown oil, ranging in gravity from 11 deg. to 18 deg. Bé.

Equipment Required

Application of an oil-burning system to any plant requires a storage tank for the fuel oil, a pumping unit for drawing the oil by suction from the storage tank and forcing it under pressure to the burners, a general piping scheme for the necessary oil and steam pipes, and the furnace changes whereby the coal-burning furnaces can be transformed to oil-burning.

The storage tank may be of either concrete or steel,

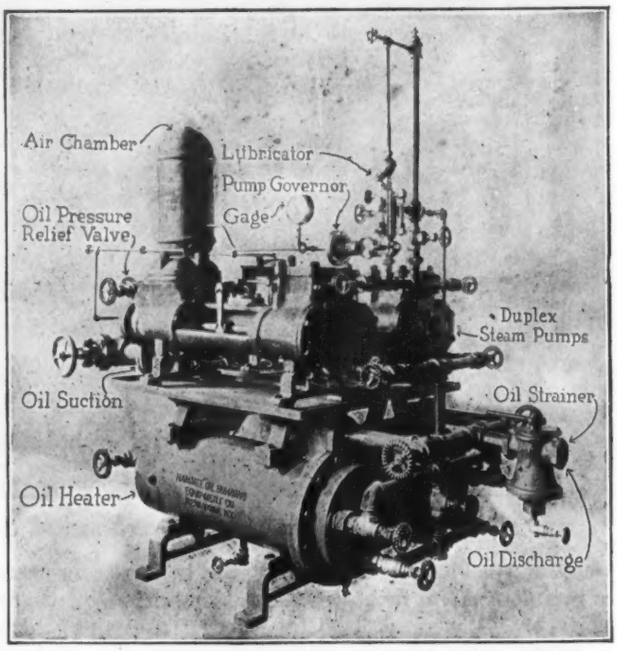


FIG. 1—COMBINED PUMPING AND HEATING UNIT FOR OIL SUPPLY

depending upon local conditions. The usual practice is to make it large enough for at least a two weeks' supply of fuel if the plant is close to an abundant source. The farther a plant is removed from an oil supply station the larger its storage should be. A safe rule is to figure 4¼ bbl. of oil of 42 gal. (156 l.) each as the equivalent of a long ton of coal. Knowing the coal consumption of a plant the size of the required oil storage can be computed. Under ordinary conditions the actual operation week by week should be much better than this approximation.

To obtain the shortest pipe lines the storage reservoir should be installed as close to the boiler room as possible, but this location should conform to any insurance or local fire regulations. Usually the reservoir is placed below ground and adjacent to a railroad siding, if oil is to be received in tank cars. As Mexican oil is extremely sluggish when cold the tank cars are equipped with a steam coil for heating the oil to a temperature high enough to permit it to flow freely. The oil outlet from the tank, which is at the bottom and near the center of the car, is either 4 in. or 6 in. (10 cm. or 15 cm.), depending upon the type of car.

There are two methods in use for unloading. Either the oil is permitted to flow by gravity into a hopper in the middle of the track or a flexible hose coupling is used to connect the car with the storage-tank filling pipe. The track hopper is the easier to manipulate. If a flexible hose is used it should be 6 in. (15 cm.) in size to accommodate the largest tank car. A hose of this size is very heavy and in cold weather becomes quite stiff and unwieldy.

For the best results the filling pipe should have as much slope as possible, because oil is extremely viscous when cold. The filling pipe should be at least 6 in. in diameter, and if the line is to have a somewhat flat slope an 8-in. or 10-in. (20-cm. or 25-cm.) pipe is preferable.

When it is impossible to install a storage reservoir where it can be filled from a railroad siding it is necessary to install an unloading pump to draw the oil through a flexible hose connection from a car and force it under pressure to the reservoir, which may be at a considerable distance. Or the tank car can discharge into a small reservoir near the siding, and from here the oil can be pumped to the main storage. In any case the long-pressure line from pump to main storage should be provided to drain the oil out when not in use, and it should be heated to keep the oil warm during pumping operations.

Pumping Unit.—Drawing the oil by suction from the main reservoir or from an auxiliary service tank, the main pump forces it under pressure to the burners. Usually this unit consists of two standard duplex-type steam pumps, specially fitted for fuel oil, and one or two heaters to give the oil the desired temperature for burning. Only one pump is required at any time, the second pump being a spare. The unit may be conveniently piped so that either or both heaters may be used with either or both pumps, and there should be included as accessories an oil strainer, a pump lubricator, an air chamber (to eliminate pump pulsation), an automatic pump governor maintaining a constant pressure for the oil discharge, an automatic oil-relief valve, a pressure gage and thermometers for indicating the temperature of the oil entering and discharging from the unit.

The exhaust steam from the pumps is used to heat the oil in the heaters, and no additional supply of live steam is necessary. The oil should reach the pump at a temperature between 80 deg. F. and 100 deg. F. (26 deg. C. and 38 deg. C.), and after passing through the heater should be between 140 deg. F. and 160 deg. F. (60 deg. C. and 76 deg. C.), which is the desired temperature for burning. Pumping units are made in various sizes to agree with the boiler horsepower of the plant. A typical pumping unit is shown in Fig. 1.

Piping System.—The general piping system consists essentially of a pump suction from tank, oil discharge from pump, oil return to tank, main steam supply and steam coils in storage tank.

To eliminate fire hazards a gravity feed should not be used, and the pump suction line should be as short and direct as possible. It is possible to have a total suction lift of about 18 ft. (5.4 m.), provided that the oil is kept at 80 deg. to 100 deg. F. and the suction distance is short. Because of the sluggish flow of the oil the suction pipe should be several sizes larger than the inlet at the pump and reduced to the proper size

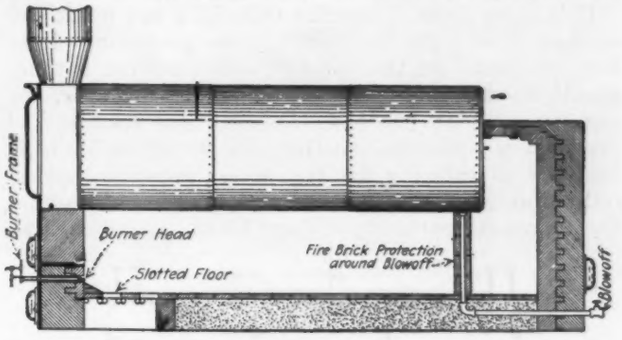


FIG. 2—FURNACE CHANGES FOR RETURN TUBULAR BOILER

near the pump. This line should be carefully tested with a vacuum gage before using to insure its being absolutely air-tight. There should be a foot valve at the suction end of the tank.

After leaving the pump the oil discharge is generally dropped below the floor level and carried in a trench along in front of the boilers, with T's at the proper places for conducting the oil to the burners. If it is desired to meter the oil a meter should be placed on the line between the pump and the first branch T at some convenient place.

As the oil return line is a continuation of the discharge line, going back to the storage tank, it should be placed in the same trench in front of the boilers. It is used to circulate the oil, especially when the system is cold and when the plant is being started after a shut-down period. This line should also carry back to the storage tank any oil which passes the automatic pressure-relief valve on the pumping unit. If a meter has been installed on the discharge line a meter should also be placed on the return line to measure any oil returned to the tank, and thus, by the difference, one may learn how much oil has been actually used.

It is important that the main steam supply should be taken from a source to insure the driest steam possible. It should have a general slope in the direction of the steam travel and should discharge into a trap at its lowest point. This main should furnish steam directly to the burners, to the pumps and to the heating coils in the tanks. If oil is received by tank car a steam line should also be extended to the railroad siding for heating the steam coils in the tank cars. Usually a reducing valve can be installed to furnish low-pressure steam for both the storage tank and the tank-car heating coils.

Steam Coils.—Every tank should have a heating coil, to maintain the oil at a temperature of 80 deg. to 100 deg. F. as it enters the pump. It is common practice to place a spiral coil incased in a hood around the foot valve of the suction pipe. This coil heats the oil where it is needed, directly around the suction pipe. Besides this spiral coil there should also be a flat coil,

made of standard lengths of pipe with open-pattern return bends, resting a few inches above the floor of the tank. This is to prevent the oil from becoming too sluggish. In some small tanks having a capacity less than 30,000 gal. (113,000 l.) it is customary to use only the flat coil. For a tank of this size a coil of twelve pieces of 1-in. (2.5-cm.) pipe, 20 ft. (6 m.) long, would heat the whole body of oil to the desired temperature, provided that the tank was below ground or otherwise protected from loss of heat through radiation.

It is quite common practice to build a box inside the storage tank with the suction pipe projecting down into one end. At the opposite end, near the bottom, should be an opening, a few inches off the floor, for admitting oil into the box. Between this opening and the suction pipe a flat heating coil should be built, so that the oil entering the box passes over the heating coil before reaching the suction pipe. Larger installations have compartment storage tanks, permitting the

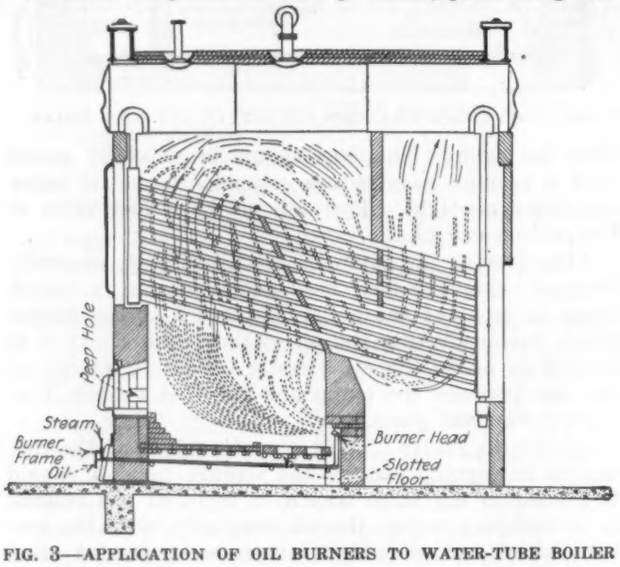


FIG. 3—APPLICATION OF OIL BURNERS TO WATER-TUBE BOILER

pumping unit to draw its oil from a different compartment from that which is being filled. In this way the oil which reaches the burners comes from the heated compartment.

FURNACE CHANGES

To change the furnace from coal-burning to oil-burning the amount of work necessary depends upon the type of boiler. The horizontal return tubular setting, so common in small plants, is readily adaptable to oil firing, as shown in Fig. 2. The grates should be removed, the bridge wall torn down to approximately the level of the top of the ashpit door, and a new floor of fire-brick laid on pipe supports, with slots between the bricks for admitting the necessary air for combustion. This air enters through the ash-pit doors. The rear portion of the floor may be laid upon an earth fill. All the walls of the furnace should be lined with firebrick above the level of the new floor. If a burner is used which thoroughly atomizes the oil no splash walls or checkerwork of any kind is required.

To prevent the blow-off pipe from being burned away it should be well protected. It may be surrounded with close fitting firebrick or wrapped with heavy asbestos rope. The burners should project only a fraction of an inch into the furnace, through a small hole cut in the cast-iron front of the boiler. This hole should be cut low, but not so low that the new floor will interfere with the free passage of air through the ash-pit door.

To fire Babcock & Wilcox, Stirling and Aultman & Taylor boilers a back-shot furnace construction has been employed with good results. In this type of construction the flame shoots from the bridgewall toward the front of the boiler and in a direction parallel to the tubes. This arrangement insures carrying maximum capacity, with no impinging action of the flame on the tubes. For this arrangement the floor of this furnace should preferably be of firebrick, usually built somewhat lower than the level of the coal-burning grates, which necessitates the removal of these grates. The firebrick floor may be supported upon pipes running across underneath the floor and resting upon ledges of red brick built along the side walls of the ash-pit.

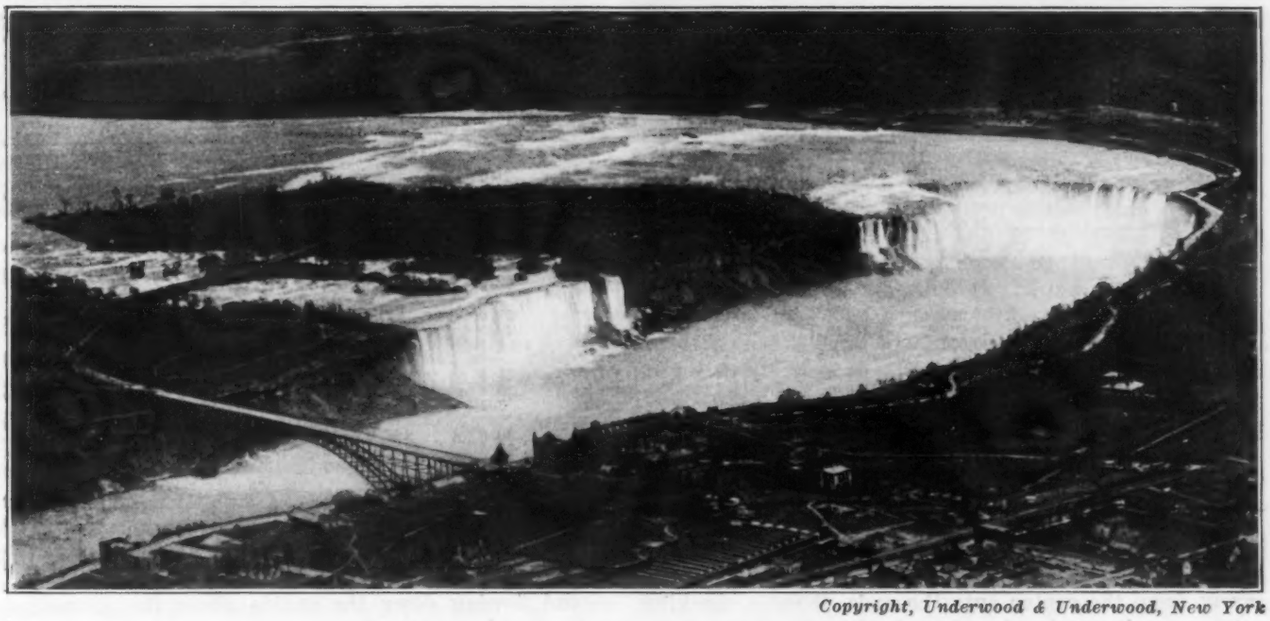
In these boilers the burner heads are placed in notches or recesses in the bridgewall, which protects them from the intense heat of the furnace. Slats may be provided in the firebrick at the floor level directly in front of the burner for admitting air for combustion. This air may enter through the ash-pit doors and travel under the floor to the slotted area. In the usual setting the new bridgewall should be placed as far in the rear of the boiler as possible, but in the Babcock & Wilcox boiler the area of the second gas pass should not be decreased an abnormal amount. To insure good combustion there should be from 8 ft. to 10 ft. (2.4 m. to 3 m.) distance between the front wall and the bridgewall. Within certain limits, the higher the boiler setting the better the efficiencies, especially at high overloads.

The number of burners for each boiler depends on several factors, including the depth of the furnace, width and number of ash-pit doors, loads to be carried by the boiler and other items. The relation between number of burners and boiler width follows: One burner for five to nine tubes in width (39 in. to 67 in.); two burners for ten to sixteen tubes in width (74 in. to 116 in.); three burners for eighteen or 21 tubes in width (130 in. to 151 in.); four burners for twenty-four or twenty-seven tubes in width (172 in. to 193 in.).

Longitudinal walls from the ash-pit floor to the bottom of the firebrick combustion chamber floor make the air supply for each burner independent of the others. With this construction it is possible to extinguish one or more burners, shutting off the corresponding air supply, and to operate the other burners without reduction in efficiency. This point is of greatest importance in plants carrying extremely variable loads and for boilers on "stand-by" service. However, it is best to equip a boiler so that under ordinary conditions, with its changing load, all of the burners may be operated with a corresponding changing intensity of fire, rather than to shut off entirely any of the burners when the load falls.

To facilitate cleaning a burner two unions may be used between the burner frame and the rest of the oil piping system, so that by turning the frame sideways both burner and frame can be slipped out of the ash-pit door.

As an oil fire develops a more intense heat than coal it is advisable to use the very best of firebrick, with a fusing point at least 3,000 deg. F. (1,634 deg. C.). These bricks should be laid without the use of a trowel. Each brick should be dipped in a thin mixture of fireclay and rubbed into place, making the fireclay joint as thin as it is possible to get it.



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Developing Niagara Falls Without Marring Its Beauty

Seven Methods of Utilizing an Additional Diversion of 20,000 Sec.-Ft., Showing Comparative Costs—573,000 Hp. to 787,000 Hp. Can Be Developed Under These Plans—Submerged Weirs Proposed as Remedy

By COL. J. G. WARREN
Corps of Engineers, U. S. A.

THE destruction or serious defacement of Niagara Falls, or any part of it, for power development or commercialization of any kind would be held almost universally—and should be beyond doubt—to be intolerable vandalism. However, there is much to be said in favor of Niagara power and its great benefits to the United States and to the world. The development already existing has made possible the growth in this country of chemical industries so important that it is difficult to see how they could possibly be dispensed with. It might almost be said that the war could not have been won without them. It is true also that some of the hydro-electric developments now existing at Niagara Falls furnish a spectacle of beauty, grandeur and sublimity almost rivaling the falls and the rapids themselves. The problem is to develop a policy which will insure preservation of the natural scenery and at the same time conserve the present power development and provide for future industrial needs.

On first thought it would seem that no harmony between these objects was possible, that power development must give way to scenic preservation. A careful study of all the facts[1] makes it clear that this is not the case; that the utmost harmony can readily be made to prevail between the two apparently conflicting interests, and, strange as it may at first seem, that scenic preservation may be promoted by a further development of power with its greater enhancement of commercial advantages.

This very satisfactory conclusion arises because of the peculiar character and growth of the Horseshoe Falls. Although they discharge sixteen times as much water as the American Falls and have a crest line two and six-tenths times as long, yet they are often held to be inferior as a spectacle to the lesser American Falls. The crest line forms a deep curve which makes it impossible to see more than about one-half of these falls at a time except from one viewpoint in Canada. In the central 1,000 ft. (300 m.) of the crest line, situated deep in the curve, more than 80 per cent of the flow over the falls plunges down over the cliff behind a thick cloud of mist. This part of the water fall is seldom more than partly visible, and then only under favorable conditions of wind, causing the spray to be blown to one side. It seems to be a fact that perhaps more than one-half of the water flowing over this cataract adds nothing at all to its grandeur, unless it be by increasing the volume of sound, while it greatly injures the scenic effect by causing a cloud of spray which hides a large portion of the falls almost perpetually. The ends of the crest line are never well covered with water and frequently are bare.

One remedy would be to construct a submerged dam or weir in the center of the rapids just above the crest of Horseshoe Falls. This would spread the water

[1]Statements as to the changed appearance of the falls are sometimes made by persons whose utterances carry weight. However, few, if any, of these observers have taken into account the changes in stage of Lake Erie at Buffalo, largely due to wind, which cause the volume of flow over the falls to change from hour to hour, day to day and year to year.

TABLE I—COMPARISON OF CONSTRUCTION COST AND TIME OF DEVELOPMENT, PROPOSED NIAGARA RIVER DEVELOPMENTS OCTOBER, 1918

	Cu.Ft. per Sec.	Gross Head, Ft.	Net Head, Ft.	Total Hp. on Busbars	Hp. per Ft.-Sec.	Construction Cost	Construction Cost per Hp.	Time of Development, Years: First Power	Time of Development, Years: Complete
1. Power canal	20,000	313.8	302.8	591,000	29.6	$43,579,000	$73.70	2½	5
2. Pressure tunnel	20,000	312.5	301.3	588,000	29.4	50,803,000	86.40	3	5
3. Tail race tunnel	20,000	312.5	299.0	584,000	29.2	52,220,000	89.40	3	5
4. Simple two-stage	20,000	312.2	297.5	580,000	29.0	61,227,000	105.60	2	4½
Upper stage only	20,000	215.2	208.2	406,000	20.3	31,528,000	77.73	2	4½
Lower stage only	20,000	97.0	89.2	174,000	8.7	29,699,000	170.78	2	4½
5. Compound two-stage	20,000	312.0	298.4	573,000	28.6	55,481,000	96.80	1	4½
Upper stage only	20,000	219.0	214.4	409,000	20.4	21,183,000	51.80	1	3½
Lower stage only	20,000	93.0	84.0	164,000	8.2	34,298,000	209.10	2½	4½
6. Ship canal:									
300 ft. wide, 40 ft. deep	20,000	316.4	312.9	611,000	30.6	198,412,000	324.70	7	10
400 ft. wide, 30 ft. deep	20,000	316.4	312.9	611,000	30.6	203,000,000	332.20	7	10
200 ft. wide, 33 ft. deep	20,000	316.4	309.9	605,000	30.2	170,000,000	281.00	6	9
Portion of works of 300-ft. canal necessitated by the power development	.....	.....	.....	.....	....	93,000,000	97.50	7	...
7. Erie and Ontario sanitary canal	26,000	326.4	310.2	787,000	30.3	401,760,000	510.50	..	...

away from the center onto the ends, thereby checking center erosion and enhancing the beauty of the falls. With this done the inequality of flow over the two falls could be partly remedied without detriment to the Canadian Falls by dumping rock into the river to form a low submerged weir between the upper end of Goat Island and the Canadian shore.

If the remedial works whose design has been outlined above are provided, it is believed that a total diversion of 80,000 sec.-ft. (2,240 cu.m. per second) may be made around the falls and 40,000 cu.ft. (1,120 cu.m.) per second around the Whirlpool and Lower Rapids without injury to the scenic beauty and without injury to the ice-discharging capacity of the falls or rapids, these diversions to be divided equally between Canada and the United States. After these diversions have been effected, it is quite possible that observation will show that further diversion is permissible, especially should the possibility of utilizing further diversion at medium or high stage only be considered.

The effects at low-water stages are the critical considerations. Under the very infrequent condition when the total river flow is 130,000 cu.ft. (3,640 cu.m.) per second, the flow over the Falls would be 50,000 cu.ft. (1,400 cu.m.) per second, of which 5,000 cu.ft. (140 cu.m.) would pass over the American Falls. The flow over the Horseshoe Falls would then be about twice as great per foot of crest line as the flow over the American Falls under average conditions and more than three times as large as during this very abnormal low-water condition. This 45,000 cu.ft. (1,260 cu.m.) per second flowing down the rapids above the Horseshoe Falls would provide 50 per cent more water per foot of width of channel than past experience has shown to be necessary in the American channel leading to the American Falls for the prevention of ice jams. The possibility of dangerous ice jams forming in the Whirlpool Rapids or Lower Rapids appears much greater than in the rapids above the falls.

It is very important also that the scenic beauty of the lower rapids should not be injured at very low stages. A careful study of photographs, profiles, gage records and other evidence leads to the conclusion that the diversions around these rapids should be limited to 40,000 cu.ft. per second until the effects of this diversion can be observed.

In the attempt to operate large hydro-electric plants very close to an authorized limit of diversion, occasional accidental peak loads may cause an unintentional overstepping of the limit. If these are not permitted, the plant must habitually be operated at less than the allowed load, thus reducing the total output of power. For this reason it would seem that the treaty and the permits issued under it should not penalize such occasional accidental excess diversions.

TABLE II—ESTIMATED ANNUAL CHARGES FOR POWER DEVELOPMENT, EXCLUSIVE OF FIXED CHARGES ON ORIGINAL OVERHEAD AND DEVELOPMENT EXPENSES

Based on use of a diversion of 20,000 cu.ft. per second October, 1918

No.	Proposition Name	Ninety per Cent of Maximum Continuous Output in Horsepower	Fixed Charges per Horsepower per Year	Operation Charges per Horsepower per Year	Cost of Power on Busbars per Horsepower per Year
1	Power canal	532,000	$8.20	$1.80	$10.00
2	Pressure tunnel	529,000	9.60	1.70	11.50
3	Tailrace tunnel	526,000	9.90	1.70	11.60
4	Simple two-stage	522,000	11.70	2.20	13.90

* The compound two-stage proposition is omitted from this table, as it is only applicable to the use of the diversion authorized by the existing treaty.

EXTENT OF TERRITORY INVOLVED

The territory involved in a comprehensive consideration of this diversion is the entire drainage area of the Great Lakes above St. Regis, N. Y., 66 miles (106 km.) above Montreal, the place at which the St. Lawrence passes entirely into Canada. This area is approximately 300,000 square miles (768,000 sq.km.), of which 59.5 per cent lies on the United States side of the international boundary line. The total area is somewhat larger than that of Texas and about one and one-half times the size of France. The land area on the United States side includes virtually all the State of Michigan and portions of Minnesota, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania and New York. The land area on the Canadian side comprises a large part of the Province of Ontario. The water surface alone is 95,205 square miles (243,725 sq.km.), or 64 per cent of this is in the United States. The main shore line involved exceeds 8,300 miles (13,350 km.) in length. The population of the basin area is estimated to be 15,000,000, of whom 2,000,000 are in Canada. At least sixteen cities of 50,000 population or more each are contained within its boundaries.

The total developable water power of the basin is estimated at 10,000,000 hp., far more than half of which is in the United States. The water power already developed within this area is roughly 1,000,000 hp. in the United States and 1,500,000 hp. in Canada.

Present diversions of water from the Niagara River at Niagara Falls for power development are given in Table IV. Since the above data and Table IV were compiled the Hydro-Electric Power Commission of Ontario has constructed an addition to the Ontario Power Company's plant increasing the diversion of that plant to about 13,300 cu.ft. (378 cu.m.). The commission also has under construction a new plant to utilize a diversion of 10,000 cu.ft. (280 cu.m.) of water per second under a head of 300 ft. (90 m.). All the other plants enumerated generate power under gross heads of 220 ft. (64 m.) or less, diverting water from the river not more than 1¼ miles (2 km.) above the falls and returning it to the river within less than a mile (1.6 km.) of the foot of the falls.

TABLE III—COMPARATIVE COST OF STEAM AND HYDRAULIC POWER AT NIAGARA FALLS, N. Y., OCTOBER, 1918
(20,000 cu.ft. per second; 526,000 hp.)

	Cost in Dollars per Hp.-Yr	
	Steam-Electric	Niagara
Coal, 6 tons at $4.50	$27.00	$0.00
Other operation and maintenance	8.00	1.90
Fixed charges (Niagara, 10 per cent; steam-electric, 13 per cent)	12.60	14.00
Profit, 3 per cent on construction cost	2.90	3.10
Selling price	$50.70	$19.00
Selling price (reduced to cents per kw.-hr.)	.78	.29
Saving per hp.-year	.....	31.70

TABLE IV—WATER DIVERSION FROM NIAGARA RIVER AT NIAGARA FALLS

Side of River	Name of Company	Diversion Cu.Ft. per Second	Totals
United States	The Niagara Falls Power Co.:		
	Niagara Plant	8,600	
	Hydraulic Plant	10,900	
	Pettebone Cataract Paper Co.	270	19,770
Canada	Hydro-Electric Power Commission of Ontario Power Co. plant	11,200	
	Toronto Power Company	12,400	
	Niagara Falls Power Co., Canadian Plant	9,600	
	International Railway Co.	125	33,325
Grand total			53,095

POSSIBLE METHODS OF DEVELOPMENT

Consideration of several plans for the further development of power from the Great Lakes drainage basin by the diversion of additional water from the Niagara River have shown the feasibility of three major types of development: (1) By a power canal, (2) by a pressure tunnel and (3) by a tailrace tunnel. Four other developments have also been investigated (see Table I), but all of them are higher in first cost and more complex in engineering requirements.[2] The power-canal development would involve diverting water just south of Connors Island and conveying it to a power plant below Riverdale cemetery where the draft-tube discharge elevation would be low enough to give 312.5 ft. (95.1 m.) gross head. The pressure-tunnel plan would require an adit just upstream from Grass Island and would run to a plant situated similarly to the one first mentioned. The tailrace-tunnel plant would involve a plant just upstream from Grass Island with a gross pressure head of 299 ft. (91.1 m.) and a tailrace tunnel extending to the lower river, raising the gross head to 312.5 ft. (96.5 m.). The two-stage developments are based on utilizing the total head in two steps of about 215 ft. and 97 ft. (65.5 m. and 29.5 m.) respectively, one plant being near the International Bridge and the other in the lower river. The simple two-stage development differs from the compound in that it contemplates an entirely new development for the use of diversion authorized by a new treaty, while the compound two-stage development is a scheme for the most efficient use of the existing diversion, utilizing the more modern portions of the Niagara Falls Power Company's present plant. The other propositions are indicated by their name.

From the tables it will be seen that the first cost of the canal proposition, omitting costs of promotion and finance, is lower than that of either tunnel proposition, being $73.70 per horsepower as compared with $86.40 and $89.40 for the tunnels. The cost of operation and maintenance would, however, be greater, but upon the assumptions in the estimates not enough to overbalance the additions in fixed charges. The tailrace-tunnel plan has several inherent disadvantages which make it of very doubtful advisability. These are the expected presence of considerable ground water in the low-level tunnel during construction, the difficulty of unwatering the tunnel in case of accident or needed repairs and the difficulty of regulating surges in the tunnel. The most important objection to the tunnel plan is that it will be necessary to shut down the entire plant for a short time and drain the tunnel in order to repair or remove obstructions from the upstream valves. This difficulty is not regarded as controlling. It could be obviated by extending the tunnel up to a surface forebay and using long penstocks, or by other means. The only formidable objection to the power-canal plan is the presence of an open canal through or near the city and the uncertain costs of maintenance due to climatic conditions. There is no reason, however, why it should not be made less unsightly than the present canal, and in fact it might even be attractive in appearance. It would, however, partly prevent the use of valuable land for other purposes, would form a dividing line disadvantageous to streets and sewer systems, and would cause the city or the company expense for building and maintaining bridges as the city grew.

A comparison of the probable cost of power at the busbars corrected to equalize distribution conditions shows that the power-canal project should show a cost of $10 per horsepower per year, as compared with $11.50 and $11.60 for the pressure and tailrace tunnels respectively.

Objections to the scheme of the Erie & Ontario Sanitary Canal Company of diverting more water from Niagara River are that all of the roads leading into Buffalo from east, west and south would be crossed. This would require about seventy movable bridges, and the consequent obstruction to traffic would be enormous. It would lower the level of Lake Erie 1.18 ft. (0.4 m.), and remedial works would be very expensive. Besides, it would produce excessive currents in the Black Rock ship canal, and there would be difficulty in crossing the New York State Barge Canal.

[2] Of course, all the proposed schemes are predicated on the ability to secure more diversion—20,000 sec.-ft. (560 cu.m.)—through international agreement.

Table I—Capacity of Generators and Prime Movers Installed in the Central Stations of the United States

State	Capacity of Dynamos, Thousands of Kw.					Steam Engines and Steam Turbines, Thousands of Hp.				Steam Engines, 1920, Thousands of Hp.	Steam Turbines, 1920, Thousands of Hp.	Gas and Oil Engines, Thousands of Hp.					Waterwheels, Thousands of Hp.				
	1902	1907	1912	1917	1920	1902	1907	1912	1917			1902	1907	1912	1917	1920	1902	1907	1912	1917	1920
Alabama	4.5	17.1	24.5	128.5	147.4	7.6	19.4	24.6	79.2	31.0	83.6	0	0	0.1	0.7	0	0.6	1.2	27.8	102.9	80.6
Arizona	1.8	4.9	14.8	27.0	56.4	1.9	6.9	12.8	23.9	9.9	26.1	0.7	0.1	0	3.6	3.0	0	0.8	9.3	11.2	39.0
Arkansas	6.0	9.7	16.3	24.9	54.3	8.2	13.6	22.6	31.5	26.6	42.4	0	0.1	0.2	2.6	1.6	0.2	0.3	3.0	2.5	2.2
California	83.8	238.5	588.3	817.0	883.4	55.2	159.6	414.2	450.2	32.3	403.7	0.6	16.6	2.0	2.2	2.6	78.9	208.4	432.1	729.0	810.3
Colorado	21.8	53.1	71.7	94.8	133.4	25.5	56.5	56.9	65.5	20.4	92.2	0	0.3	0.1	0.5	0.2	12.8	25.6	77.0	74.0	78.3
Connecticut	15.5	18.0	19.4	152.6	187.9	21.4	37.5	89.4	162.0	18.5	169.2	0.4	0.7	0.9	0.8	0.7	6.6	18.0	19.4	32.4	40.5
Delaware, D. of C., and Maryland	21.6	63.0	87.1	131.2	225.6	29.5	83.6	108.0	199.9	34.7	280.0	0.1	0.1	1.1	1.2	0.9	0.3	1.6	4.0	3.0	15.3
Florida	4.7	7.8	23.6	37.8	57.5	6.1	14.3	27.6	50.5	22.9	53.4	0	0.1	0.5	2.0	3.7	0	0	5.7	5.7	7.0
Georgia	7.6	35.4	56.2	84.3	246.6	6.5	18.2	35.3	50.1	41.6	80.3	0	0.1	0.7	0.5	3.3	6.1	36.3	52.0	75.1	223.4
Idaho	2.8	7.1	35.7	37.1	101.8	1.5	2.2	4.5	2.7	4.5	0	0.1	0	0	0.1	0.1	3.9	11.5	51.9	53.6	126.6
Illinois	100.3	209.2	450.0	737.6	987.0	117.1	287.9	605.2	982.7	161.4	712.3	0.2	0.9	3.0	4.7	2.7	9.5	10.5	37.4	59.0	114.0
Indiana	38.1	81.6	135.8	227.8	343.8	52.0	95.9	159.9	270.2	68.0	317.6	1.1	1.3	1.7	3.3	6.0	1.1	19.6	23.9	27.7	28.8
Iowa	24.9	32.1	53.2	184.5	301.5	36.7	42.3	67.4	90.7	65.7	124.0	0.4	0.6	2.7	7.3	4.4	2.4	3.8	7.0	165.9	160.4
Kansas	8.6	30.3	69.2	143.3	138.1	12.2	38.0	82.4	167.9	41.9	106.9	0	1.7	7.1	22.0	19.3	1.0	8.7	8.8	18.0	26.1
Kentucky	15.0	29.1	54.1	69.4	113.4	21.3	42.0	81.1	96.1	26.8	120.2	0.1	0.1	0.6	2.3	1.5	0.1	0	0	0.4	0.2
Louisiana	7.8	15.2	19.2	25.8	87.4	13.7	22.9	26.2	29.3	37.4	73.0	0	0.4	1.0	6.8	4.1	0	0	0	0	35.2
Maine	15.3	39.3	58.8	63.2	122.8	11.8	18.1	19.6	22.5	16.8	16.9	0	0	0.1	0.2	0.3	13.0	39.8	69.9	75.6	186.0
Massachusetts	90.6	135.9	252.7	478.9	763.6	115.2	170.5	323.1	555.2	68.7	773.6	0.1	1.1	3.2	6.3	0.6	8.9	16.8	24.5	119.0	139.2
Michigan	44.2	101.7	247.8	450.7	529.4	48.6	97.9	250.5	411.6	44.2	427.5	0.1	0.6	1.6	3.0	1.8	16.1	85.7	125.1	198.0	216.5
Minnesota	21.0	78.5	93.5	162.8	229.9	28.1	48.7	63.2	119.0	34.0	139.2	0.7	1.4	4.8	8.1	7.5	6.0	71.7	80.2	98.4	157.7
Mississippi	5.1	9.9	21.9	23.2	42.5	7.7	15.5	30.5	32.2	20.3	30.2	0	0.1	0.1	1.0	1.1	0	0	0	0	0
Missouri	32.1	68.5	122.8	166.8	347.2	44.3	108.5	177.7	200.0	59.7	392.9	0	0.9	2.5	7.4	5.7	1.0	2.0	1.9	18.7	27.3
Montana	22.1	39.6	74.4	182.1	146.4	7.9	11.8	12.8	8.1	11.6	2.5	0	0	0.1	1.4	1.3	24.0	57.0	102.9	334.9	303.4
Nebraska	8.4	20.0	34.6	78.2	85.7	10.4	26.2	42.5	89.1	25.5	68.3	0.1	0.8	3.8	12.5	10.4	1.8	3.0	5.9	10.5	12.5
Nevada	0.8	5.7	10.5	12.4	21.2	0.3	0.2	2.2	1.1	0.9	1.9	0	0.5	0.7	0.6	0.4	1.4	6.3	12.5	15.1	15.4
New Hampshire	17.8	31.9	57.8	65.6	52.4	12.6	20.3	25.4	34.8	23.0	21.0	0.1	1.1	1.9	1.2	1.1	15.4	25.4	56.9	57.3	46.0
New Jersey	46.1	70.6	179.5	249.5	320.3	67.3	90.5	235.6	353.0	74.7	351.6	0.4	1.3	2.4	12.7	2.9	1.0	1.8	1.6	2.1	1.3
New Mexico	1.0	3.8	8.0	12.7	10.5	1.7	4.0	8.4	13.2	7.0	3.9	0	0	1.8	3.3	2.8	0.1	0.5	0.8	0.6	0.6
New York	187.3	482.0	772.0	1,211.9	1,466.4	192.6	413.4	638.9	1,052.3	90.6	1,335.9	2.0	3.3	6.5	5.9	5.2	128.8	306.0	512.4	694.9	738.8
North Carolina	4.1	13.9	43.1	144.0	191.1	4.6	10.7	15.0	68.2	21.3	81.3	0	0	0.1	0.4	0.3	1.9	10.0	50.0	150.7	169.6
North Dakota	2.0	5.8	10.8	20.0	23.1	3.8	10.0	15.9	24.7	19.4	6.4	0	0.2	0.3	4.4	3.7	0.1	0.1	0	0	0
Ohio	69.8	126.5	244.2	420.4	1,046.9	101.3	171.4	317.2	556.2	138.8	1,050.0	0.8	5.6	11.3	11.9	11.3	1.7	2.0	8.9	13.6	40.7
Oklahoma	3.0	15.5	38.3	57.8	79.5	4.4	22.4	45.9	66.8	44.2	43.5	0	0.2	6.0	12.9	11.5	0	0	2.1	1.4	1.8
Oregon	11.2	32.6	32.4	47.9	132.2	6.6	24.6	15.9	27.1	18.9	47.5	0	0.2	0.3	0.6	0.3	11.2	102.1	29.8	41.1	132.0
Pennsylvania	121.4	212.5	427.3	910.4	1,078.6	166.7	264.2	466.0	1,104.1	162.5	1,062.1	1.8	7.5	17.7	19.5	12.6	7.0	30.9	132.3	166.6	205.1
Rhode Island	12.1	21.0	38.5	106.0	145.3	15.7	24.7	46.9	131.0	6.0	183.8	0	1.0	1.1	1.1	1.1	1.9	2.3	2.4	3.7	2.7
South Carolina	13.4	51.3	32.4	167.9	222.5	10.8	8.5	39.5	27.1	10.6	28.0	0	0.2	0.5	0.6	0.4	10.4	75.4	178.6	248.1	279.6
South Dakota	2.9	10.0	20.0	24.2	29.1	4.0	10.3	16.0	15.8	7.9	14.6	0.2	0.5	4.8	10.0	10.8	0.8	2.2	6.9	6.4	7.0
Tennessee	14.7	20.9	49.6	145.3	173.8	18.4	27.5	40.8	69.7	16.4	91.6	0	0	0.5	0.6	0.4	0.6	1.2	27.8	131.7	98.0
Texas	26.1	48.6	84.6	133.9	199.0	33.7	66.1	113.6	156.8	60.5	175.9	0.1	3.1	9.5	24.7	28.3	1.1	2.8	3.5	3.4	4.1
Utah	13.9	33.6	37.9	147.4	81.8	2.1	1.3	1.0	34.2	11.9	21.3	0	0	0	0	0	18.4	34.7	59.6	192.4	95.6
Vermont	11.4	21.8	29.5	51.8	87.2	7.4	9.9	15.0	17.3	7.8	12.6	0.1	0.2	0.1	0.1	0.1	16.3	28.5	35.3	56.4	106.5
Virginia	3.8	9.2	40.5	65.9	165.3	4.2	5.0	15.1	40.2	13.1	158.2	0	0.1	0.2	0.9	5.6	1.2	9.6	44.3	49.9	49.9
Washington	13.7	66.3	57.3	99.9	331.3	5.7	11.0	18.1	36.3	18.3	60.5	0	0.1	0.2	0.6	0.4	17.2	56.1	77.6	114.2	341.4
West Virginia	7.0	14.7	29.8	103.6	202.1	10.1	16.9	34.1	114.1	16.3	196.0	0.6	0.9	3.1	10.1	19.2	0.1	3.6	6.0	6.5	3.5
Wisconsin	23.1	40.7	98.8	252.6	342.4	27.0	37.8	72.1	219.5	79.9	196.1	0.9	2.1	4.5	4.6	4.7	7.8	19.0	68.8	144.1	204.6
Wyoming	1.8	3.2	8.2	20.6	25.9	2.7	4.4	10.1	22.8	6.9	15.8	0.5	0	0.1	1.9	1.6	0.1	0.8	1.3	2.7	2.7
Sections																					
New England	162.8	289.4	514.9	918.1	1,359.2	184.2	280.9	519.4	922.8	140.8	1,177.1	0.7	4.1	7.3	9.7	3.6	62.2	130.7	208.5	344.4	520.9
Middle Atlantic	354.8	765.1	1,378.8	2,371.8	2,865.3	426.7	768.1	1,340.5	2,509.4	327.8	2,749.6	4.2	12.1	26.6	38.1	20.7	136.8	338.6	646.3	863.6	945.2
South Atlantic	62.3	195.3	412.8	2,734.7	1,310.7	71.9	157.3	274.5	550.1	160.5	877.2	0.7	1.4	6.1	15.7	33.4	20.1	136.5	340.5	539.0	748.3
North Central	375.5	805.1	1,580.7	2,868.9	4,404.1	485.6	974.9	1,869.9	3,160.4	746.4	3,555.8	4.6	16.7	48.1	99.2	88.6	49.4	228.3	374.7	760.3	995.6
South Central	82.2	166.0	308.4	608.8	897.3	115.1	229.3	385.2	561.6	263.2	660.4	0.2	3.8	17.8	51.6	48.5	1.9	11.3	46.3	242.3	222.1
Mountain	66.0	151.0	261.1	534.1	577.4	43.5	87.4	108.8	171.5	73.1	163.7	1.2	0.9	2.7	11.4	9.4	60.7	137.0	315.3	684.5	661.6
Pacific	108.7	337.4	678.0	964.8	1,346.9	67.5	195.2	448.2	513.6	69.3	511.7	0.6	16.9	2.5	3.4	3.3	107.4	366.6	539.5	884.3	1,283.7
United States	1,212.2	2,709.2	5,165.4	9,001.9	12,760.9	1,394.4	2,693.3	4,949.8	8,389.4	1,781.1	9,695.5	12.2	55.8	111.0	229.1	207.5	438.5	1,349.1	2,469.2	4,318.4	5,377.4

Central-Station Capacity Increasing Fast

Analysis of Central-Station Developments Indicates a Total Installation of 12,760,900 Kw. on Jan. 1, 1920—Gain During 1919 Reaches Approximately 9.8 per Cent—Prime Movers in Central Stations Total 17,061,600 Hp.

ONE of the most fundamental axioms in the physical world is that unless the heart of a being is functioning regularly and efficiently that being cannot be considered as a healthy normal organism. This principle is applicable to the industrial world as well as to the physical. The central station is the mother of the electrical industry, and prime movers and generators may well be considered as respectively its lungs and heart, their general health being therefore indicative of the prosperity of the electrical industry as a whole. Continual growth is an essential element of the industry if it is to attain its rightful place in the commercial world. In an endeavor to ascertain the growth of central-station installation in the last twenty years the ELECTRICAL WORLD has compiled the data to be found in the table on page 332. The figures for the years 1902, 1907, 1912 and 1917 are taken from census reports of the United States Census Bureau. The figures for 1920 are for the most part taken from the 1920 edition of the McGraw Central Station Directory and Data Book, which is to be issued this month.

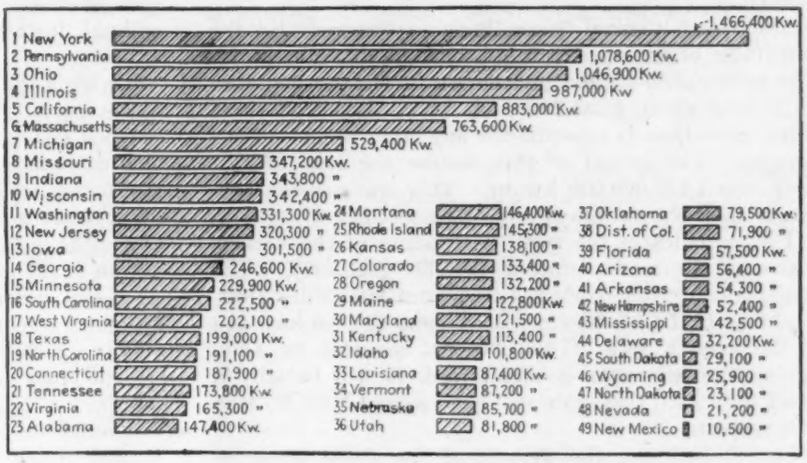

1 New York 1,466,400 Kw.
2 Pennsylvania 1,078,600 Kw.
3 Ohio 1,046,900 Kw.
4 Illinois 987,000 Kw
5 California 883,000 Kw.
6 Massachusetts 763,600 Kw.
7 Michigan 529,400 Kw.
8 Missouri 347,200 Kw.
9 Indiana 343,800 "
10 Wisconsin 342,400 "
11 Washington 331,300 Kw.
12 New Jersey 320,300 "
13 Iowa 301,500 "
14 Georgia 246,600 Kw.
15 Minnesota 229,900 Kw.
16 South Carolina 222,500 "
17 West Virginia 202,100 "
18 Texas 199,000 Kw.
19 North Carolina 191,100 "
20 Connecticut 187,900 "
21 Tennessee 173,800 Kw.
22 Virginia 165,300 "
23 Alabama 147,400 Kw.
24 Montana 146,400 Kw.
25 Rhode Island 145,300 "
26 Kansas 138,100 "
27 Colorado 133,400 "
28 Oregon 132,200 "
29 Maine 122,800 Kw.
30 Maryland 121,500 "
31 Kentucky 113,400 "
32 Idaho 101,800 Kw.
33 Louisiana 87,400 Kw.
34 Vermont 87,200 "
35 Nebraska 85,700 "
36 Utah 81,800 "
37 Oklahoma 79,500 Kw.
38 Dist. of Col. 71,900 "
39 Florida 57,500 Kw.
40 Arizona 56,400 "
41 Arkansas 54,300 "
42 New Hampshire 52,400 "
43 Mississippi 42,500 "
44 Delaware 32,200 Kw.
45 South Dakota 29,100 "
46 Wyoming 25,900 "
47 North Dakota 23,100 "
48 Nevada 21,200 "
49 New Mexico 10,500 "

FIG. 1—RELATIVE STANDING OF THE SEVERAL STATES AS TO CENTRAL-STATION INSTALLED CAPACITY

The table is an astonishing revelation of the growth of the central station. The total installed generator capacity of the central stations in 1902 was only 1,212,200 kw., while the total capacity at the opening of 1920 was 12,760,900 kw., an increase in eighteen years of about 953 per cent. The increase in generator installation during the past year was about 1,149,000 kw., or 9.8 per cent. This increase in installed capacity has been very general throughout the country, although the South Atlantic States have far outstripped the others in percentage growth since 1902. This section shows an increase during that period of more than 2,000 per cent, or from 62,300 kw. to 1,310,700 kw., and what is more significant, the new installations in this section during the past three years have been greater than in any other section of the country with the exception of the North Central States. The South Atlantic States present a most thriving field for electrical operations. According to the *Manufacturers' Record*, which collects detail statistics on industrial growth in the South, plans for the first half of 1920 throughout the cotton-growing states involved the installation of 928,619 spindles, indicating an investment of more than $44,707,450, as compared with 769,609 spindles in 1919 with an invest-

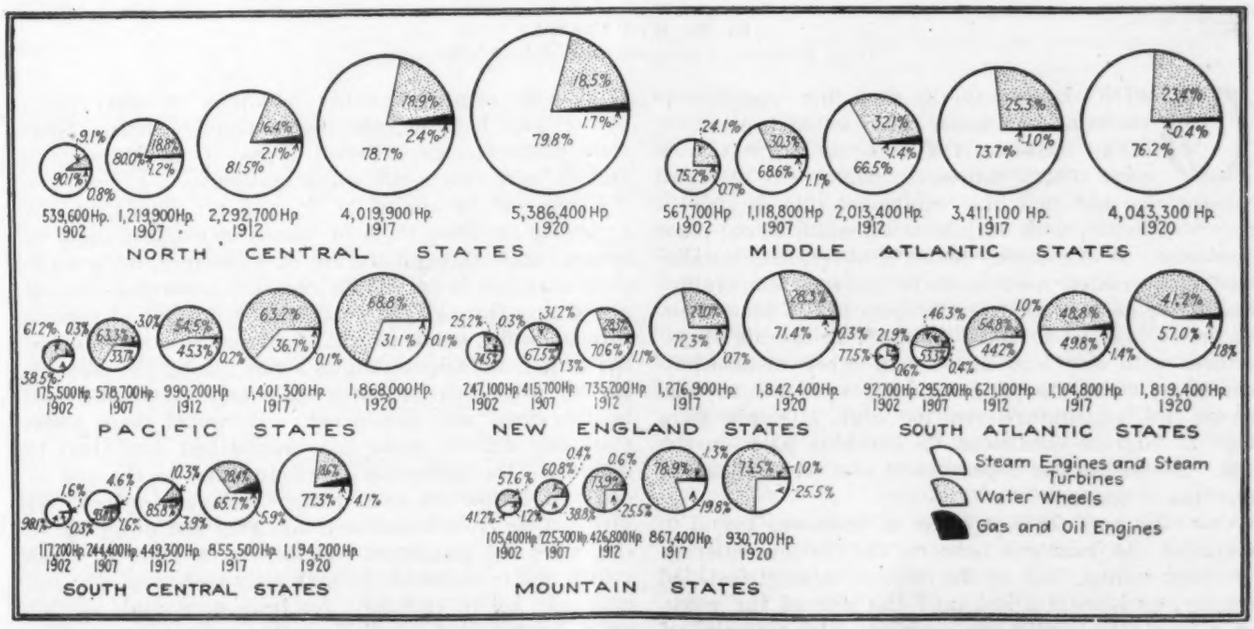


FIG. 2—GROWTH OF THREE TYPES OF PRIME MOVERS IN THE VARIOUS SECTIONS OF THE COUNTRY

ment of about $53,000,000. The looms for the first half of 1920 exceed the total for 1919 by more than 7,000. This equipment of looms called for an investment of $5,520,600, as compared with $3,325,000 for the 11,084 looms reported during all of the year 1919. At least 90 per cent of these textile mills, it is stated, will be electrified.

The North Central States have continuously led the remainder of the country in total installation since 1902. The new central-station installation in this section since 1917 was about 1,535,200 kw., which is about three times more than is reported for any other section of the country. The output of this section for May of this year was 1,148,000,000 kw.-hr. This was considerably larger than the output of any other section.

Fig. 1 indicates the relative standing of the various states as to central-station installed capacity. The leadership of New York has been continual since 1902, but since 1917 Ohio has increased some 620,000 kw., and if the growth rate of 190,000 kw. recorded by Ohio during the past year is maintained, it will be only a short time until that state will have passed New York in this respect.

Fig. 2 indicates the growth of the three types of prime movers in the various sections of the country. The relative extent of adoption of steam and falling water as sources of motive power in the central stations of the country is clearly indicated by the diagrams. Steam-engine and steam-turbine installations predominate everywhere except in the Mountain and Pacific States, where the total installed waterwheel capacity is about two and one-half times the rating of steam-driven movers. Taking the country as a whole, it is intesresting to note that at every period given in the table the total steam-engine and steam-turbine installation is approximately twice the total waterwheel installation. The rapid growth of the electrical industry in the South Atlantic States during the last few years has resulted in the total steam installation passing the waterwheel installations, but this is the only instance in which during the period under consideration the predominant installation has switched from one type to another.

Ohio leads the Union in total steam-engine and steam-turbine installation, but New York with its large developed water powers easily leads in total capacity of prime movers.

California leads in total water-power development by central stations and has continuously led the other commonwealths in this type of motive power throughout the eighteen years indicated.

Gas and oil-engine installations have decreased in most states during the past three years. About the only states in which this type of motive power has increased in recent years are the South Atlantic States and Texas. The total for the country is not large in comparison with either steam or water.

Probably one of the most interesting facts to be deduced from the tabulation is the large increase in installation during the past year despite the high cost of material and scarcity of funds. Nothwithstanding these adverse conditions, the demand for electrical energy has been insistent and the returns to the public utilities have been sufficiently attractive to warrant new installations on a par with those of previous years, if not in excess of them. What the new installations would have been during 1919 under normal financial conditions can only be surmised.

Calculating Transformer Vault Ventilation

Relation Between Cubic Feet of Vault Capacity, Temperature Rise and Transformer Losses—How to Calculate Size of Ventilator Openings and Height of Chimney—Method of Solving a Typical Problem

By W. W. PARKER
Testing Engineer Commonwealth Edison Company

OWING largely to the fact that transformer vaults are not under the constant supervision of an operator, the tendency at first with some central-station companies was to crowd transformers and switching equipment into as small a space as possible, with very little attention to the place so selected. It was quickly found, however, that installations thus created were liable to extreme temperature conditions; in fact, the room temperature in some cases became so high as to make it unsafe to operate transformers with any load at all. In other installations conditions, owing to pure accident, were not so bad. Where the temperature ran too high attempts were made to improve conditions by knocking holes in the walls. Sometimes the improvement was very noticeable, but often it was not.

About January, 1916, a series of tests was begun to determine the relations between the factors entering into vault cooling, such as the relation between installed capacity, or kilowatts lost, and the size of the room, the size of the ventilation openings, the material of which the vault was constructed, the location of the vault with respect to other buildings or other parts of the same building, and the prevailing winds. Tests were made on ten different types of vaults, and all factors were taken into consideration.

Vaults can be cooled by forcing air into them, by removing air from them by means of exhaust fans, by natural draft through the use of a chimney, or by sufficient openings to permit the required amount of cooling air to pass through the rooms. The amount of cooling through walls, windows, etc., while considerable during the winter, is insignificant as a rule during the summer period, when ventilation is extremely important, and is therefore not considered. It would have been extremely difficult under the various test conditions to determine the difference in cooling due to the use of concrete, hollow tile and brick. Corrugated-iron vaults give trouble from moisture condensing and dropping on the buses and insulators. There was only one of these vaults, and it seemed to be extremely cold in winter and unusually hot in summer. No tests were made at this vault because load conditions were very unsteady.

In order to determine the advantages of vaults con-

structed of various materials, it would have been necessary to construct various test vaults where external temperature conditions could have been maintained constant or controlled at will. It is recognized that it is possible to calculate more or less exactly the cooling effect of the floors, ceiling, roof and windows, and thus determine the amount of waste heat to be removed for any predetermined power installation, and then calculate the size of ventilator opening required to permit the requisite amount of heated air to be removed. But such results could only be applied to one particular vault, unless all vaults were standardized as to size, material and architecture. The effects of the material used must be small in comparison to the cooling due to ventilator openings; hence these tests deal only with ventilation.

In determining the ventilation or cooling desired, it is necessary to consider that during the winter period the vaults must not be cooled too much or the oil will congeal in the oil wells and prevent operation of the oil switches. The permissible rise of room temperature above outside air temperature must be such that the transformers under rated load will not have a maximum temperature greater than 85 deg. C. to 90 deg. C., at which point fibrous insulations begin to deteriorate. Thus on hot summer days, when the outside air temperature is around 104 deg. Fahr. or 40 deg. C., the room temperature should not be greater than 50 deg. C. or 10 deg. C. higher than outside air. Generally the extremely high temperature mentioned occurs for only a brief period and a temperature of say 95 deg. Fahr. or 35 deg. C. is as high as need be considered. Such a temperature will permit a room or vault temperature rise of 15 deg. C. without danger of operating the transformers, which usually have a specified rise at full load of less than 40 deg. C. at a dangerous temperature. Such a rise appears to any one entering the vault as excessively high, because the vault feels too hot, yet owing to the purpose of the vault comfort is not a factor to be considered. A 15-deg. rise, however, should be considered the limit. To keep the temperature at this point 75 cu.ft. to 100 cu.ft. of air per minute per kilowatt transformer loss must be removed from the room.

The use of fans either to force air into the room or exhaust it from the room would be an easy and effective way to keep the temperature down, but it would be expensive, and the fans would require frequent attention, thus losing the chief advantage of a vault. So, except in cases where an electrician is present at the plant at all times, a fan arrangement would not be recommended. Of the other two methods, the chimney method is the best and is recommended for practically all vaults. The vault which is isolated or exposed to prevailing winds can be satisfactorily ventilated by permitting air to blow through and remove the heat.

TYPICAL TEST DATA FOR VAULT NO. 1

In the summary are given the results of tests of nine other vaults.

Wall	Material	Area (Sq.Ft.)	Remarks
East	Brick	160	No windows
West	Brick	160	12 sq.ft. windows
North	Brick	800	No windows
South	Brick	800	56 sq.ft. doors 47 sq.ft. windows 14 sq.ft. ventilator
Roof	8-in. concrete	720	
Floor	8-in. concrete	720	

Vault is in a pocket; tall building is 20 ft. south; railroad tracks elevated at rear and on both sides; windows on west end were at level of tracks.

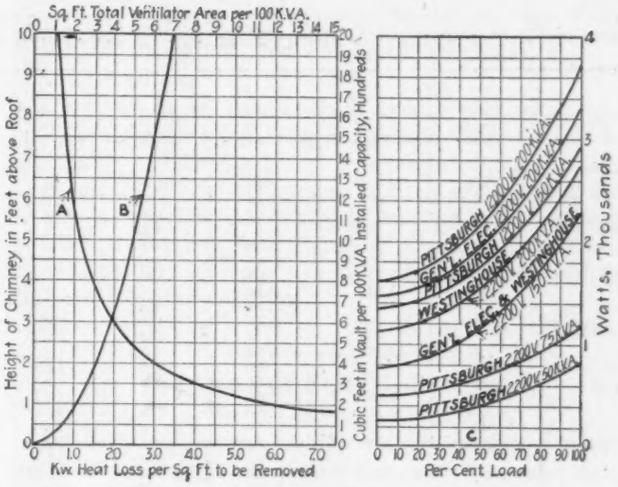
Total radiating surface (floor included)	3,360 sq.ft.
Total radiating surface exposed to weather	1,700 sq.ft.
Net volume of vault (deducting transformers)	9,220 cu.ft.
Area of ventilator openings (south wall only), 7 sq.ft. at floor level, 7 sq.ft. nr. roof	
Usual vault day load	700 kva.
Number of transformers	Six 200-kva., one 150-kva.
Iron and copper losses (day)	17,500 watts
Iron and copper losses (night)	11,000 watts
Vault capacity	1,350 kva.
Vault capacity per 100-kva. capacity	720 cu.ft.
Ventilation area (total) per 100-kva. capacity	1.03 sq.ft.
Radiating surface per 100-kva. capacity (total)	250 sq.ft.

	Test 1	Test 2	Test 3
Deg. C. rise of vault above outside air	18	11	10
Watts loss per deg. C. rise per cu.ft. capacity	0.105	0.106	0.17
Watts loss per deg. C. rise per sq.ft. radiating surface	0.29	0.29	0.47

Test 1—Usual load; light cold north wind, sprinkling rain.
Test 2—No load; light northwest wind.
Test 3—Usual load; west wind.

IMPORTANCE OF PREVENTING PRECIPITATION OF MOISTURE

In many cases the switch rooms are constructed independent of the vault, in a separate building of room, or in a space partitioned off from the transformer room.


Sq. Ft. Total Ventilator Area per 100 K.V.A.
Height of Chimney in Feet above Roof
Cubic Feet in Vault per 100 K.V.A. Installed Capacity, Hundreds
Watts, Thousands
A
B
C
PITTSBURGH 1200V 100 KVA.
GEN'L ELEC. 2200V 100 KVA.
PITTSBURGH 2200V 150 KVA.
WESTINGHOUSE 2200V 100 KVA.
GEN'L ELEC. & WESTINGHOUSE 2200V 150 KVA.
GEN'L ELEC. 2200V 75 KVA.
PITTSBURGH 2200V 75 KVA.
PITTSBURGH 2200V 50 KVA.
Kw. Heat Loss per Sq. Ft. to be Removed
Per Cent Load

VENTILATION REQUIREMENTS MAY BE SAFELY CALCULATED FROM THESE CURVES

A—Relation between ventilator area and cubic feet of vault capacity. B—Relation between height of chimney in feet and kw. of heat loss per square foot of chimney area for a 15-deg. rise in the vault. C—Iron and copper loss for various type of transformers. These curves are typical but should be used only for approximations.

In these cases it is important to see that the switch room is well ventilated and is warmed in the winter. The best plan is to have sufficient openings between the switch room and the transformer room to permit a free flow of air between the two rooms. This recommendation does not apply in cases where the air thus circulated would be full of moisture or ammonia or acid fumes. The idea is to keep both transformer vault and switch room at a temperature above the external air temperature. In some cases it will be necessary to resort to artificial heating. It is necessary to have the switch room warm during the cold weather, because if it is not, when the weather turns warm suddenly, as it frequently does, the warm outside air coming into the vault and in contact with the cold switch frames, marble switch panels, switches, etc., precipitates moisture which may cause trouble from leakage.

Trouble is especially liable to result in the case of those vaults where a large amount of coal dust and dirt is present, with which the water mixes, forming a conducting medium. Precipitated moisture alone is not a very good conducting medium, but the effect is to decrease insulation resistance, even on clean insulators, and to increase static discharges. Hence provision must be made to prevent precipitation of moisture.

Ten vaults of different physical characteristics were tested as shown in the typical record of vault No. 1. These data are summarized as to the main points in

the tabulation. It is to be noted principally from this tabulation that for the vaults showing a rise of approximately 15 deg. C. the relation between cubic feet per 100 kva. capacity and the watts loss per degree rise per cubic foot of vault capacity is such that the resulting curve would form a rectangular hyperbola of the form $XY = k$.

It is also found that the points plotted for the relation between the vault capacity per 100 kva. and the ventilator area in square feet per 100 kva. of installed capacity for vaults within the temperature limits fall approximately on a curve whose equation is $XY = 2{,}400$, where X and Y are respectively the variables enumerated above. The results of various tests indicate that the figures plotted on curve A can be safely used in determining the amount of ventilation space required to ventilate any vault so located as to be exposed to some extent at least to the prevailing winds.

SUMMARY OF RESULTS OBTAINED FOR TESTS OF TEN VAULTS OF VARIOUS TYPES OF CONSTRUCTION

Vault No.	Total Kva. in Vault	Cu.Ft. per 100 Kva.	Ventilator Area per 100 Kva.	Load During Test Kva.	Average Increase in Temperature Deg. C.	Watts Loss per Degree Rise per Cu.Ft. Capacity	Watts Loss per Degree per Sq.Ft. Radiation	Maximum Rise for Full Kva. Load in Vault Deg. C.	Remarks
1	1,350	720	1.03	650	18.0	0.105	0.29	26.0	25,100 watts, full-load loss
			1.03	0	11.0	0.106	0.29		
			1.03	600	10.0	0.170	0.47		
2	505	448	2.6	400	9.0	0.323	0.612	....	7,000 watts, full-load loss
			1.69	200	6.0	0.369	0.685		
			1.69	200	9.0	0.246	0.467		
			1.69	430	15.0	0.197	0.374	16.4	Chimney ventilator in roof
	1,600	1,047	1.74	0	8.0	0.093	0.37	....	29,600 watts, full-load loss
			1.74	950	12.0	0.096	0.38		
			1.74	100	9.0	0.083	0.31	19.3	Normal ventilation conditions
			0	850	26.0	0.045	0.18	39.2	Ventilator closed
4	750	2,290	2.85	400	4.5	0.071	0.28	....	Roof ventilators closed; day load
			2.85	150	12.0	0.034	0.14	21.9	Roof ventilators closed
			3.72	400	5.5	0.100	0.40	7.5	12,800 watts, full-load loss
5	1,350	1,248	2.06	575	10.0	0.100	0.400	14.9	25,100 watts, full-load loss
6	4,575	755	7.89	125	11.0	0.096	0.223	26.7	8,850 watts, full-load loss, subway
7	300	428	0.13	0	13.5	0.099	0.155	36.8	4,670 watts, full-load, loss
8	225	240	1.3	190	23.0	0.256	0.321	25.3	3,500* watts, full-load, loss
			8.0	190	13.5	0.437	0.548	14.8	
9	275	213	0.60	200	33.0	0.187	0.237	39.8	4,360* watts, full load loss
			8.22	200	20.5	0.331	0.382	22.5	
10	470	743	6.9	275	8.0	0.180	0.625	11.4	7,160 watts, full load loss

* Increased ventilation.

METHOD OF SOLVING A TYPICAL PROBLEM

For example, suppose that 600 kva. in transformer capacity is to be installed in a room 12 ft. x 20 ft. x 135 ft. high (3.6 m. x 6.1 m. x 41 m.). Determine the amount of ventilation required to limit the rise to 15 deg. C. under full-load conditions. $12 \times 20 \times 13.5 = 3{,}240$ cu.ft. (91.6 cu.m.) vault capacity. Assume 340 cu.ft. (9.6 cu.m.) to be the displacement of the three 200-kva. transformers. The cubic feet in vault is therefore 2,900 (82 cu.m.); then

$$2{,}900 \div 6 = 483 \text{ cu.ft. (13.7 cu.m.) per 100 kva.}$$

Referring to curve A 483 cu.ft. (13.7 cu.m.) capacity per 100 kva. requires 5 sq.ft. (1.55 sq.m.) ventilation area per 100 kva., or a total of 30.6 sq.ft. (9.34 sq.m.) of ventilator area distributed half at the floor line and the rest at the ceiling line. The upper ventilators must be as nearly as possible at the highest points in the room. A monitor on the roof is an ideal arrangement.

As mentioned before, the best method of ventilation is by means of a chimney as nearly as possible directly over the transformer bank. The curve and formula given herewith take no account of the size of the vault but only of the amount of heat to be removed. Consequently the chimney will probably be larger than necessary for a vault where the cubic feet of space per 100 kva. is large—exceeding 1,000 cu.ft. (28.3 cu.m.) for example—but not too small for extremely small vaults—less than 200 cu.ft. (5.6 cu.m.) per 100 kva. This formula is

$$X = 1.1\sqrt{h},$$

where X is the kw. of heat loss removed per square foot of chimney area of a height "h" and is derived as follows: Allowing 25 per cent for friction losses, the velocity of air through a chimney is:

$$V = 360\sqrt{\frac{h(T_1 - T_2)}{T_2}},$$

where T_1 and T_2 are absolute temperatures of the air at the base of the chimney and the external air respectively. 1,650 cu.ft. (46.7 cu.m.) of air will have its temperature raised 1 deg. C. per minute by 1 kw. Allowing a 20-deg. rise at the base of the chimney, then 82.5 cu.ft. (2.3 cu.m.) of air will be removed for each kw. of loss. For a chimney 1 ft. (0.304 m.) high and 1 sq.ft. (0.093 sq.m.) in cross-section, with an outside temperature of 30 deg. and a rise of 20 deg. at the base, the quantity of air is $360\ 1(20/303) = 92.5$ cu. ft. per minute. One square foot of cross-sectional area will therefore take care of 92.5/82.5 or 1.1 kw. of heat loss. Substituting,

$$\text{kw. loss per square foot} = 1.1\sqrt{h}$$

To apply the above to a vault to determine the ventilation required by means of a 5-ft. (1.5-m.) chimney, assume a vault with three 200-kva. transformers installed. Assuming 98 per cent efficiency, the kw. loss at full load would be 12 kw. Referring to curve B it will be seen that a 5-ft. chimney would remove 2.46 kw. of heat loss per square foot of area. Hence the area of the chimney would need to be 12/2.46, or 4.88 sq.ft. (1.5 sq.m.), or a chimney about 30 in. in diameter. An equivalent area of ventilators would have to be distributed about the four walls at the floor line. In addition to the two curves mentioned, a curve is included which will give the iron and copper losses of the various transformers used in the vaults for any percentage of load.

It is believed that the problem of determining the proper amount of ventilation for a transformer vault can be quickly solved by the use of the curves. It is probable also that these figures could be successfully applied to the ventilation of substations. Vaults of the subway or manhole type should, if possible, be ventilated by means of a chimney.

Readers' Views and Comments

Canadian Water Powers

To the Editor of the ELECTRICAL WORLD:

SIR: I note in your July 3 number a map showing the water powers of North America on which Canada is credited with an installed capacity of less than 1,800,000 hp. According to recent official returns, the total water power installation in Canada, Jan. 1, 1920, was 2,417,896 hp.

JAMES WHITE,
Assistant to Chairman.

Commission of Conservation, Ottawa, Canada.

The International Electrotechnical Commission

To the Editor of the ELECTRICAL WORLD:

SIR: When the International Electrotechnical Commission organized in London in 1906 by delegates from most of the civilized countries of the world I had the honor of being a guest in the home of Colonel Crompton, the father of international standardization, which he first proposed at the St. Louis Electrical Congress in 1904. Lord Kelvin, Sir William Preece, Ayrton, Perry and Sylvanus Thompson, also Mr. Herdt, the Canadian delegate, were all friends of mine, I am proud to say. So that, being myself descended from American ancestors of English stock, British and American co-operation was assured. But the French, Belgian, Swiss, Italian, Spanish, German and Austrian representatives were inclined to hold aloof. This was very natural when it is remembered that this organizing meeting was largely arranged by English and Americans and was held in London. Any such attitude on the part of the continental Europeans, however natural, would undoubtedly have caused a deadlock, or at best little would have been accomplished, if C. O. Mailloux, the other American delegate, had not possessed very thorough knowledge of the subject and of the various national temperaments, which in an international conference are often more important than facts. Not only did he understand the points of view of the different nationalities but he could make explanations to and convince any of the foreigners in the foreigner's own native language, were he Frenchman, Belgian, Swiss, Italian, Spaniard, German or Austrian. Such a combination of knowledge and talent is most remarkable and practically irresistible. Hence the first meeting in 1906 was a success and a very satisfactory organization was effected, as is proved by the fact that the commission has functioned very well ever since then.

Mr. Mailloux not only acted as interpreter between the English-speaking delegates and the continental Europeans but was also able to serve in that useful capacity between the different non-English-speaking nationalities. In other words, he was a universal interpreter. Moreover, he could correctly translate and convey not only the words but the ideas and principles involved, and very good principles, ethical as well as technical.

It is most appropriate, therefore, that Mr. Mailloux should now be president not only of the American committee but of the entire International Electrotechnical Commission. Practically all countries of any importance are represented on the commission by duly appointed representatives, with an honorary secretary, who is, of course, Colonel Crompton, and a very efficient general secretary, C. Le Maistre, with a permanent central office in London. No one ever deserved such an honor more surely than Mr. Mailloux deserves to be president of the I. E. C.

My object in writing this letter is not only to record an interesting and significant event in electrotechnology but it is also to give some measure of recognition to the invaluable services of Mr. Mailloux in starting and maintaining the activities of the I. E. C.—really the first important international body to carry into effect engineering co-operation and uniformity as to terms, standards, methods and similar particulars in the various countries.

Moreover, in an article which appeared in your issue of July 10 more credit was given to me than I deserve, especially in this matter of international standardization, and Mr. Mailloux's name and the great credit due to him were not mentioned. As I had nothing to do with publishing the article referred to I cannot be accused of stealing Mr. Mailloux's thunder, but I do not want to be guilty of even shunting a portion of it.

New York City. FRANCIS B. CROCKER.

The Value of Rainfall Records

To the Editor of the ELECTRICAL WORLD:

SIR: Nearly every public utility company which operates hydro-electric stations is keeping some rainfall records for its own particular benefit. Many are also keeping records of flow of various streams for present and future use. Some of these records are being kept in co-operation with the United States Weather Bureau and the United States Geological Survey, the State Engineer's department or the Conservation Commission. All of them would be of much greater value if they could be brought together and published by one central authority in a publication covering the entire state.

In the present state of things there is no particular advantage in holding these records under cover, as it is possible with the accumulation of data now available to make a fairly close estimate of rainfall and run-off in a particular locality. At the present time the New York State section of the United States Weather Bureau is publishing rainfall records from approximately eighty stations scattered throughout the state and also temperature records from the great majority of these stations. There are undoubtedly half as many more rainfall records being kept by private persons or interests throughout the state which would add greatly to the value of the data, if reported with the eighty-odd records now being published by the Weather Bureau. It would seem as if the various persons or companies keeping these records might well arrange to keep and report them in co-operation with the organizations mentioned and thus increase the value of the service to themselves as well as to others. It is probably through a lack of appreciation of the benefit that would thus be insured that many of these records are not so kept and published.

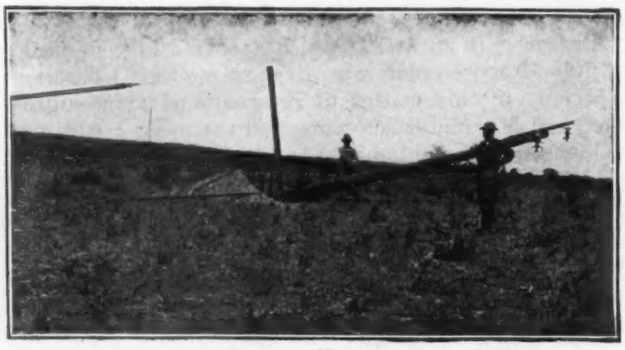
BYRON E. WHITE,
Utica, N. Y. Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Raising Poles with Insulators Attached Saves Time

BY COMPLETELY assembling the cross-arms and insulators on transmission poles and towers before they are raised into position considerable time is saved in the line construction operations of the Utah Power & Light Company. This assembling is done while the



TIME SAVED BY ASSEMBLING CROSS-ARMS AND INSULATORS BEFORE RAISING POLE

structure is on the ground, and then the entire structure with fittings is erected as a unit. This practice applies to all types of structures—single-pole, two-pole, A-frame or steel towers. The photograph shows the method of erecting a single-pole 44-kv. structure with insulators attached.

The saving in time results from the fact that it is much easier to handle the insulators while standing on the ground than it is at the top of a pole or tower. Moreover, the time and trouble of lifting up cross-arms, insulators, fittings and tools is eliminated.

PAUL P. ASHWORTH.

Utah Power & Light Company,
Salt Lake City, Utah.

Comparison of First Cost of Fuel Oil and Coal-Burning Plants

IN COMPARING the first cost of a coal-burning plant with that of an oil-burning plant, the cost of stokers and ash-handling equipment must be balanced against the cost of oil-storage tanks. The use of fuel oil avoids the necessity of the purchase of mechanical stokers and auxiliary equipment, which might range in cost from $8 to $14 per rated boiler horsepower. The fuel oil also avoids the necessity of equipment for handling coal and ashes, which would cost about $8 to $10 per rated horsepower. This would make a total of about $20 per horsepower.

As an offset to these items fuel oil requires storage tanks, oil pumps and heaters, which will cost anywhere from $10 to $30 per horsepower, depending upon the amount of reserve oil which is to be kept in storage.

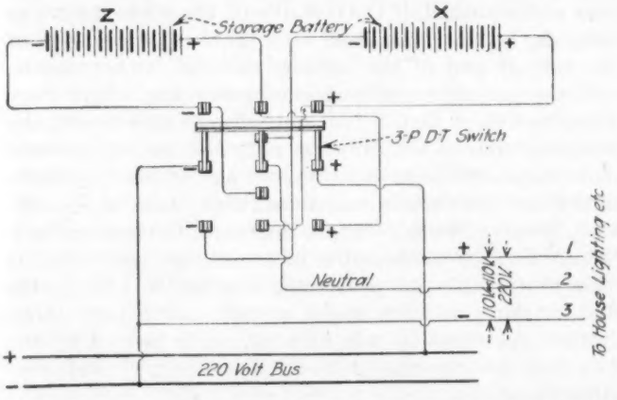
For a central station of 5,000 hp. capacity the complete oil-burning equipment with storage tanks for five months' supply of oil has been estimated at $250,000. This would be at the rate of $50 per horsepower. An industrial plant could, of course, get along safely with much less than a five months' supply of oil on hand, but in almost any plant there will be little if any decrease in first cost in favor of fuel oil.

F. H. DANIELS,
Sanford Riley Stoker Company, General Manager.
Worcester, Mass.

Equalizing Battery Discharge on Unbalanced Load

TO OBTAIN even discharge on both halves of a battery feeding an unbalanced three-wire system, a three-pole, double-throw switch with two extra jaws on the middle blade is employed by an Eastern central-station company. This battery feeds a 220-volt bus used in emergency to supply excitation for synchronous condensers, etc., and the three-wire, 220/110-volt bus used to supply house lighting and pilot lights and to operate remote-control circuits, etc. The load on this latter bus is unequally divided on each side of the neutral. This necessitated installing the switch so that the heavy load may be carried alternately by different halves of the battery.

As can be seen from the diagram, the polarity of either of these circuits is the same for either position of the double-throw switch. In the "up" position of



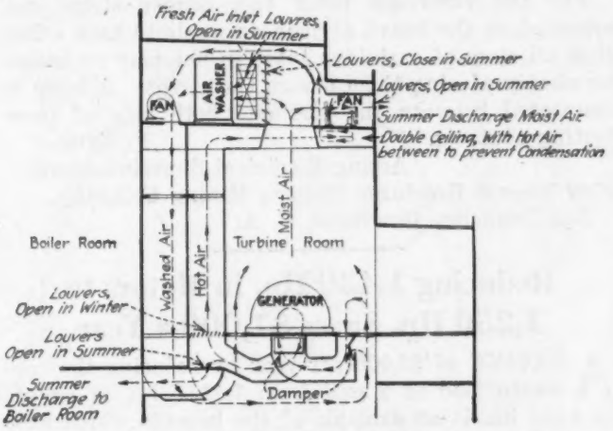
EXTRA JAWS ON THREE-POLE SWITCH INSURE EVEN BATTERY DISCHARGE TO UNBALANCED LOAD

the switch, however, the half of the battery (*X*) is across 1 and 2 of the three-wire bus, and in the "down" position it is across 2 and 3. By reversing this switch once a day it is possible to obtain a perfectly even discharge of the whole battery.

Ampere, N. J. EUSTACE C. SOARES.

Ventilating System Which Prevents Condensation in Turbine Room

TO PREVENT the condensation of escaped steam from the No. 10 unit in the Delray plant of the Detroit Edison Company a double ceiling has been built into which hot air is forced. Ordinarily in a turbine room the steam which escapes from valves and glands of the turbine rises and spreads through the room, condensing on the surface of the windows and ceiling, from which it falls back through the turbine room. By means of the system installed at the Delray plant the ceiling and the upper part of the room are heated so that the moisture in the air will not be condensed but



WARM AIR CIRCULATED WITHIN THE DOUBLE CEILING OF TURBINE ROOM PREVENTS PRECIPITATION OF MOISTURE

will be drawn out through the opening in the ceiling by the ventilating fans. The other objects of this ventilating system are: (1) To cool the generator with washed air; (2) to collect and remove water vapor escaping from the turbine; (3) to furnish hot air to the stokers in summer; (4) to heat the turbine and condenser rooms in winter and cool them with washed air in summer.

The operation of the system in the summer, as may be seen from the accompanying drawing, is as follows: A ventilating fan above the room sends down washed air below the floor of the room, part of the air passing through the generator and from there to the stokers in the boiler room and part passing up into the generator room and through the opening in the ceiling, where it is discharged by the exhaust fan (at the right in the drawing) to the outside of the building. In the summer the ventilating fan draws air through the air washer from the outside through the fresh-air inlet near the top of the building. This cool air keeps the generator and the generator room from becoming too warm. In the winter the washed air is sent through the generator and turbine rooms as before, but the air which has passed through the generator now passes upward through a pipe instead of into the boiler room. This pipe leads to the interior of the double ceiling, thus warming the ceiling and preventing the precipitation of moisture. From the ceiling it passes back into the ventilating fan. The moist air from the turbine room, instead of passing into the open air as in summer, is again drawn in through the air washer and sent back through the ventilating fan. The fresh-air inlet at the top of the building is closed in winter to prevent the entrance of cool air. By means of the louvers and dampers shown the system can be regulated for any condition of winter or summer temperature.

A somewhat similar system has been designed for the Marysville station of this company. This differs from the Delray system principally in the substitution of a curtain of hot air, which is blown across the ceiling, in place of the double ceiling with the air space as shown in the drawing

SABIN CROCKER.
Detroit Edison Company,
Detroit, Mich.

Thickness of Cable Insulation Differs Widely with Different Companies

THICKNESS of insulation of cables for different voltages as installed by a number of the larger operating companies is shown in the accompanying table. This table shows data on three-conductor and four-conductor cable for 750 volts to 26,400 volts and on single-conductor cable from 250 volts to 13,000 volts. The data include the size of conductors used and the insulation thickness for the conductor wrapping and the outside belt insulation. These figures represent the most recent practices of the respective companies. It will be noted that in some cases the thickness of outer

INSULATION THICKNESSES AND OPERATING VOLTAGES OF CABLES OF VARIOUS COMPANIES

Name of Company	Operating Voltage	Size A.W.G. or C.M.	Insulation, 64ths Inch: Conductor	Insulation, 64ths Inch: Belt
THREE-CONDUCTOR AND FOUR-CONDUCTOR CABLES				
Milwaukee	26,400	No. 00	18	18
Baltimore	26,000	No. 0000	18	10
Boston	25,000	.....	18	12
N. Y. Edison	25,000	350,000	17	8
Detroit	24,000	No. 00	18	14
Toledo	23,000	300,000	18	14
Cleveland	22,000	No. 2	20	20
Chicago	22,000	350,000	19	7
Pittsburgh	22,000	250,000	18	10
Los Angeles	20,000	No. 0000	16	16
N. Y. Edison	15,000	350,000	14	14
San Francisco	15,000	No. 0000	13	13
Milwaukee	13,200	.....	14	14
Louisville	13,200	250,000	14	14
Toledo	13,200	133,000	12	10
Baltimore	13,000	No. 0000	16	4
Chicago	12,000	500,000	13	6
Los Angeles	12,000	No. 0000	14	14
Cleveland	11,000	No. 0000	16	4
Pittsburgh	11,000	No. 0000	14	12
N. Y. Edison	8,000	350,000	10	10
Louisville	7,500	No. 8	8	8
Baltimore	6,600	No. 0000	10	8
Toledo	6,600	250,000	8	8
San Francisco	5,000	No. 0000	8	8
Detroit	4,800	200,000	10	10
Cleveland	4,600	No. 0000	8	8
Louisville	4,000	250,000	10	10
Baltimore	4,000	No. 0	8	6
Chicago	4,000	No. 0	6	5
Louisville	4,000	No. 0000	6	6
Los Angeles	2,500	No. 0000	6	6
San Francisco	2,500	No. 0000	6	6
Cleveland	2,300	No. 0	6	4
Pittsburgh	2,300	No. 0000	8	6
San Francisco	750	No. 0000	4	4
SINGLE-CONDUCTOR CABLES				
Baltimore	13,000	1,250,000	20	..
San Francisco	750	1,500,000	8	..
Los Angeles	600	1,000,000	6	..
Toledo	600	1,000,000	10	..
Louisville	600	1,000,000	6	..
Chicago	300	No. 0000 to 1,500,000	8	..
N. Y. Edison	300	1,000,000	10	..
Cleveland	300	1,000,000	8	..
Detroit	250	1,000,000	8	..

belting has been reduced until it is possible to transmit peak loads as high as 10,000 kw. over one cable with an over-all diameter not exceeding 3 in. (7.5 cm.).

These data were compiled for the recent Pasadena convention of the N. E. L. A. by the committee on underground systems.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

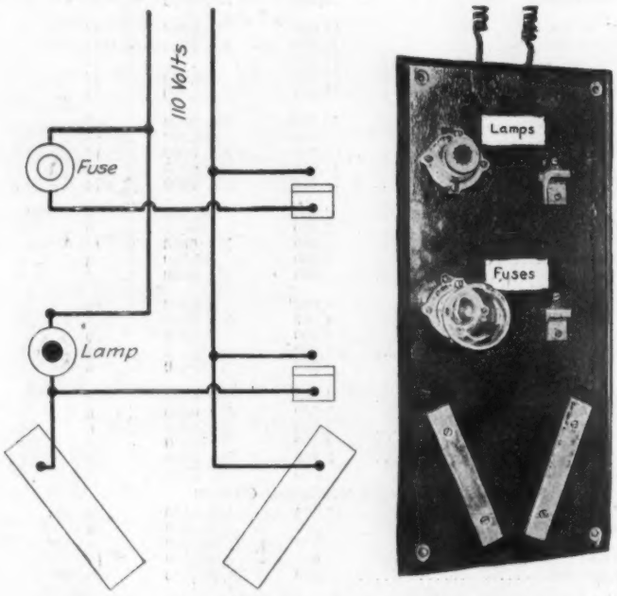
The Best Way to "Take Speed"

THE use of a speed indicator for counting the revolutions of a shaft in a given time is very simple, but the best results are seldom obtained. One man should hold both the watch and the speed indicators; then there will be no time lag at the start and finish. Since he can read only one thing at a time, let it be the watch. He will not need to look at the indicator while taking speed as he can count the hundreds of revolutions as the litt'e knob on the disk passes under his middle finger. By attaching a large rubber tip on the end of the counter a grip is provided for the thumb and forefinger which permits of accurate releasing and stopping of the indicator as the second hand of the watch touches the dot. The number of revolutions above the last hundred are read from the disk after the indicator has been withdrawn from the shaft.

Pittsburgh, Pa. D. W. BLAKESLEE.

Board for Quick Tests of Lamps and Fuses

FOR quickly testing lamps and fuses, the test board shown in the accompanying illustrations has proved very useful. The lamps, plug fuses and cartridge fuses are tested by simply touching them for a second to the proper contact points. The contacts for lamps and plug fuses consist of a brass flat-head screw for one terminal and a ledge made of scrap brass for the other. When the screw terminal of a lamp is laid on the brass ledge the center terminal of the lamp strikes on the flat-head screw. A fuse is connected in series with the contacts to prevent damage by a short-circuited lamp. The contacts for testing plug fuses are similar to those for testing lamps.



BOARD FOR QUICKLY TESTING LAMPS, PLUG FUSES AND CARTRIDGE FUSES

For the cartridge fuses two copper strips are mounted on the board at such an angle to each other that all sizes of cartridge fuses in use may be tested by simply placing them across the strips. A lamp is connected between the line and both sets of fuse-testing contacts.

F. KRUG,
Acting Electrical Superintendent.
New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.

Reducing 1,430 Hp. in Motors to 1,250 Hp. Saves $1,000 a Year

A SAVING of $1,000 per year by reducing the connected load of a mill from 1,429.5 hp. in motors to 1,252 hp. is an example of the benefits which have resulted to industrial plants from an investigation that has been carried on by the New England Power Company among its customers. The average load on the motors was 789 hp. This change raised the load on each motor so that the average efficiency was increased from 87 per cent to 90 per cent and the power factor was raised from 76.5 per cent to 88.5 per cent, resulting in a saving in motor losses of $1,000 per year as stated. Raising the power factor was the primary object of the company in making these investigations. Overmotoring was shown to be chief cause of low power factor. The investigation showed that the power factors in eight classes of installation varied from 71 per cent lagging to 95 per cent leading as the accompanying table shows.

POWER FACTOR OF VARIOUS CLASSES OF INDUSTRIES

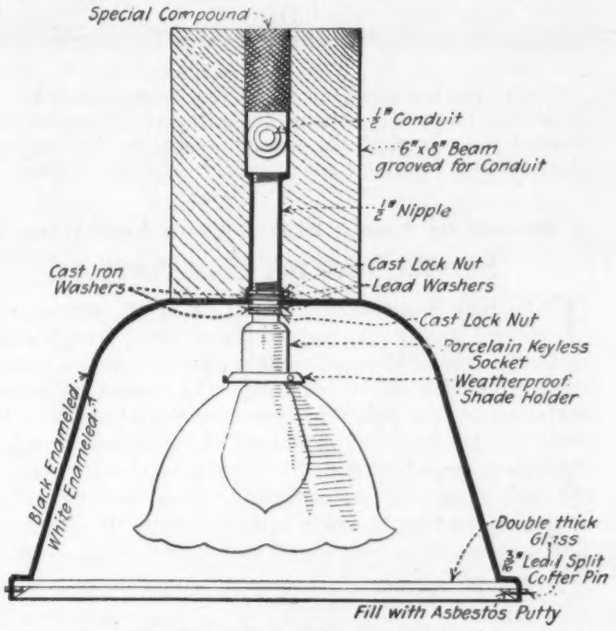
Classification	Connected Load, Kw.	Power Factor
Textile manufacturing	4,480	0.78 lagging
Paper manufacturing	3,670	0.71 lagging
Wire manufacturing	1,850	0.76 lagging
Small central stations supplied	9,860	0.72 lagging
Machine shops	1,050	0.73 lagging
Metal trades	3,560	0.90 lagging
Street railways	350	0.95 leading
Miscellaneous	3,915	0.86 lagging

The most flagrant offenders were mills operating a large number of induction motors, particularly at partial ratings. As a result of the power-factor survey many changes were made in the motor installation. In one mill purchasing 1,400 kw. it was found that two 400-hp. synchronous motors could be substituted for induction motors. This change will increase the power factor of the mill from 71 to 85 per cent, and this reduction will decrease the feeder and transformer losses enough to cover the additional cost of the synchronous motors in about one year.

Acid-proof Construction for Conduit and Lamps

FOR protecting conduit runs and lamps against acid fumes in the plants of du Pont de Nemours & Company the construction shown in the accompanying drawings has proved very efficacious. The conduit is protected by running in a groove cut in the 6-in. x 8-in. (15-cm. x 20-cm.) wooden beam. After the conduit is laid this 4.2-in. (11-cm.) groove is filled with a special compound called rubrax. The whole of the exposed surface of the beam is then given a coating of the rubrax. The lamps are inclosed in a heavily enameled reflector, which is closed at the bottom by a double-thick clear glass. This glass is held in the reflector by means of lead split cotter pins. The cracks between the glass and the rim of the reflector are closed by a fillet of asbestos putty. A weatherproof shade holder and a porcelain keyless socket are employed. For fastening the reflector on to the nipple leading from the conduit cast-iron lock-nuts and washers, in conjunction with lead washers, are used. W. B. TODD.

E. I. du Pont de Nemours & Company,
Wilmington, Del.



ACID-PROOF REFLECTOR AND METHOD OF PROTECTING CONDUIT USED IN ACID PLANTS

Rewinding a 220-Volt Induction Motor for 550 Volts

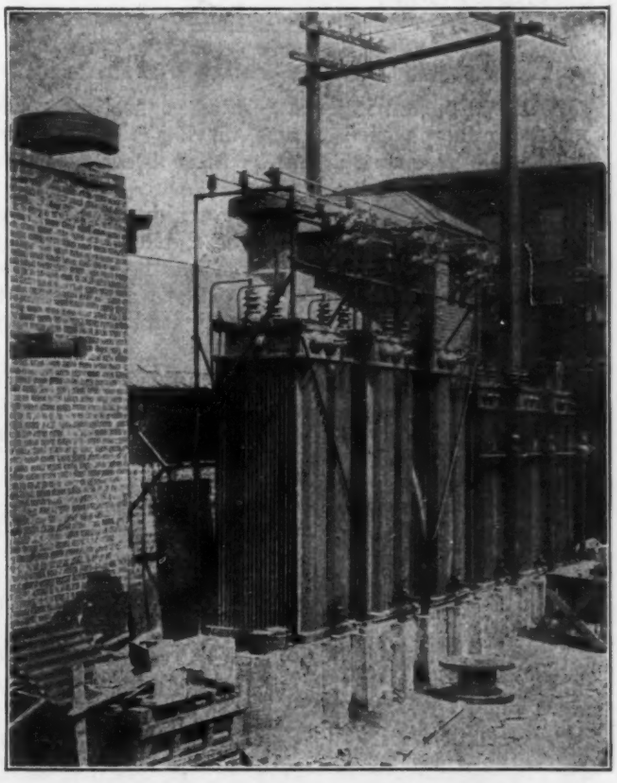
A 220-VOLT induction motor was recently sent into a repair shop in an Eastern city to be changed for operation at 550 volts. This motor, which was a 25-hp., two-phase, 60-cycle, eight-pole machine, was connected two-parallel, but if it were reconnected in series it would be good for only 440 volts, which is 25 per cent less than the required voltage, and therefore the motor had to be rewound.

The 220-volt two-parallel winding, which may be considered as a 440-volt series winding, consisted of ninety-six coils of six turns of 0.152-in. x 0.091-in. double-cotton-covered ribbon wire, wound flat with a coil pitch of one-and-ten. Considering this as a 440-volt winding, the turns per coil required for the 550-volt winding would be equal to $6 \times 550 \div 440 = 7\frac{1}{2}$ turns. If a seven-turn coil with a pitch of one-and-ten were used, the horsepower would be decreased, and therefore, in rewinding the coil pitch was increased to one-and-twelve. The one-and-ten pitch cord factor was 0.9239, while the one-and-twelve cord factor was 0.9914, and a seven-turn coil with this cord factor is equivalent to a seven-and-a-half turn coil with the original cord factor, as shown by the equation $7(0.9914 \div 0.9239) = 7.5$. The cross-section of the copper wire was decreased 25 per cent by decreasing its thickness from 0.091 in. to 0.068 in. The motor was then rewound for 550 volts with ninety-six coils, consisting of seven turns of 0.152-in. x 0.068-in. double-cotton-covered ribbon wire per coil wound flat with a pitch of one-and-twelve, and the coils were connected in series. This winding proved satisfactory under loads which it had been carrying for some time.

Bronx, N. Y. C. A. JOHNSON.

Compact Industrial Substation in Narrow Space

AS ONLY 20-ft. x 4-ft. (6-m. x 1.2-m.) space was available for a substation of a Massachusetts industrial plant, the six transformers were mounted as shown in the illustration in a single row on concrete piers elevated about 15 in. (38 cm.) above the ground. Primary connections to one bank are made to insulated buses at the top, carried on pipe framing. The other bank is fed through underground cables terminating in potheads at the transformers. The secondary leads are run into the brick building at the rear, which contains metering and switching equipment controlling various industrial-plant feeders in the district served.



SIX TRANSFORMERS IN A ROW IN NARROW OUTDOOR SUBSTATION

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Central Station and Contractors Share Soliciting Expense

AT THE beginning of the present year the new-business department of the Buckeye Power Company at East Liverpool, Ohio, set out to increase the residential lighting load in that city. Owing to the high cost of building material there were few newly built houses to be connected, and most of the department's efforts were directed toward wiring old houses. The results for the first three months of the present year show a net gain of 214 residential consumers against a total of 334 for the whole of 1919.

The campaign is carried on in co-operation with the contractor-dealers. By an agreement the company pays one-half of the solicitors' salary plus a commission on the first month's light bill, the contractor paying the balance of the salary plus a commission on total new business secured by the solicitor. This plan is proving highly satisfactory, and the overhead cost of soliciting has been cut in two.

Charges for Reconnection of Service

CHARGES covering the cost of connecting service for a short period of time, moving meter to a new location and reconnecting service after disconnection for non-payment are made by the Helena (Ark.) Gas & Electric Company. Regulations governing these charges, which have been approved by the Public Utility Commission of the State, are printed on the reverse side of receipts for meter deposits and are a part of the service application signed by the customers. The provisions read as follows:

In consideration of the application on reverse side hereof, I agree:

1. In case I vacate said premises without written notice to the Helena Gas & Electric Company, said deposit shall be forfeited in full.

2. In case I discontinue said service within one year, $2 of said deposit shall be forfeited to pay expenses incidental to rendering service for a short period of time.

3. In case meter is requested to be moved to another location within one year, to pay $2 for said change before the meter is moved.

4. In case meter is disconnected for non-payment of bills, to pay $2 for the cost of reconnecting before service is again rendered.

5. In case of failure to pay any indebtedness when due, this deposit shall be used forthwith, and without notice, to pay said indebtedness, in full or in part, and that service may be discontinued until the amount forfeited is repaid to the company.

6. It is expressly understood that the amount of service rendered shall be determined by meter, ownership of which is retained by the company; and further, that the company does not guarantee a constant supply of gas or electricity and shall not be held liable for damages caused by any interruption of variations in said service.

7. It is further understood that this receipt must be returned for cancellation upon discontinunce of service and demand for refund of the deposit covered by this receipt; also that this receipt is not negotiable or transferable.

Canvass of Customers Shows Company's Service 98.9 per Cent Perfect

TO CHECK up on the condition of its service and correct any causes for complaint, the Northern Connecticut Light & Power Company, Thompsonville, Conn., made a canvass of its customers by means of return postal cards. On one-half of the card the words "For the Good of the Service" explained the company's object. Customers were asked to fill out the return card advising the company of any complaint concerning the service or dissatisfaction in their relations with the company. The statement to customers and return card read as follows:

FOR THE GOOD OF THE SERVICE

To our Patrons:

Along with all public utilities we lost the services of many of our old employees during the war and we were obliged to carry on our business with a material shortage in our forces.

Opportunities for employment in other branches at unusually high wages since the close of the war have also made many changes in our employees.

Probably the efficiency of our service has thereby been affected, and it is our aim to correct this condition in every way.

As a guide in this matter and to help us give you the best service possible, we ask you to return to us answers to the questions on attached card, also any suggestion that you have to offer.

We solicit your co-operation and would appreciate any complaint that you may have not covered by these questions, as it is our desire to render service as nearly perfect as skill and constant attention can make it.

Yours respectfully,

WALTER P. SCHWABE,
Vice-president and General Manager.
Northern Connecticut Light & Power Co.

RETURN CARD

Is your electric service satisfactory?

.....

Is your gas service satisfactory?

.....

Is the treatment received at the hands of our employees satisfactory?

.....

Have you any complaint about the attention given you by any particular department?

.....

If your answer to any of the above is "No," please state your complaint in detail and also any suggestion that you have that would correct this matter.

DATE..... NAME.....
ADDRESS.....
.....

Commenting on the results, Walter P. Schwabe, general manager of the company, states that 3,400 cards were mailed to cover approximately 5,000 gas and electric customers. The number of cards returned stating that service was satisfactory in every respect was 318; the number returned with complaints, 60; showing that only 1.1 per cent of the customers had any complaint to make and that the company was giving 98.9 per cent perfect service.

Power-Factor Penalty Applied to Kilowatt-Hours Consumed

POWER contracts of the properties operated by the American Gas & Electric Company for demands of more than 100 kva. carry a power-factor clause whereby a percentage of correction for power factors above or below 85 is made on the kilowatt-hours used. This correction is appplied by means of a table of constants based on the average power factor for the month. The power-factor provision reads as follows:

The rates in this tariff are based upon the maintenance by the consumer of an average power factor of 85 per cent for each month as shown by integrating instruments. When the average monthly power factor is above or below 85 per cent, the kilowatt-hours as metered will, for billing purposes, be multiplied by the following constants:

Effective Monthly Power Factor	Constant	Effective Monthly Power Factor	Constant
1.00	0.951	0.70	1.0835
0.95	0.965	0.65	1.1255
0.90	0.981	0.60	1.1785
0.85	1.000	0.55	1.2455
0.80	1.023	0.50	1.3335
0.75	1.050		

Constants for other than the effective power factors given in the table are determined from the same formula used to determine the given constants.

Thus for an average power factor of 85, which is taken as standard, the customer will be billed for the amount of energy consumed as shown by the kilowatt-hour meter. But when the power factor is below or above 85 the metered kilowatt-hours are multiplied by the constant corresponding to the power factor. For example, suppose that the true energy used during the month was 100,000 kw-hr. and an average power factor of 75 was maintained. Multiplying 100,000 kw.-hr. by 1.050, the constant for 75 per cent power factor gives 105,000 kw.-hr. for which the customer would be billed. Had an average power factor of 95 been maintained, the constant 0.965 would have been used and the bill rendered for 96,500 kw.-hr.

In this manner the customer is penalized by the correction of the energy consumption to include a portion of the reactive volt-ampere-hours when the power factor is below 85 and compensated for maintaining a power factor above that point. This method has the advantage of being applied directly to the metered kilowatt-hours, where it belongs, and does not take the form of a discount or addition to the bill after the demand and energy changes have been computed regardless of power factor.

Industrial Lighting Offers Increased Revenue for Central Stations

CENTRAL stations as a rule have been very lax in acting in an advisory capacity to their customers on matters pertaining to industrial illumination, the manufacturers looking upon them merely as sources of power supply. While light is indispensable and at the same time one of the cheapest commodities on the market today, factories are frequently underlighted. Higher intensity of illumination has effected marked increases in factory production and the additional lighting uses more energy. What this means to the central station supplying power to a large industrial load can be appreciated from the fact that heretofore mills and factories using one-half watt or less per square foot of floor surface are now changing over to an illumination intensity of 1.5 watts to 2 watts per square foot—an increase of from 200 to 300 per cent.

It may seem that the companies furnishing electrical supplies and power are pushing the idea of high-intensity illumination for purely selfish motives; but this is far from being the case. Good lighting is about the cheapest thing in plant operations, as the following figures on a normal cost will show.

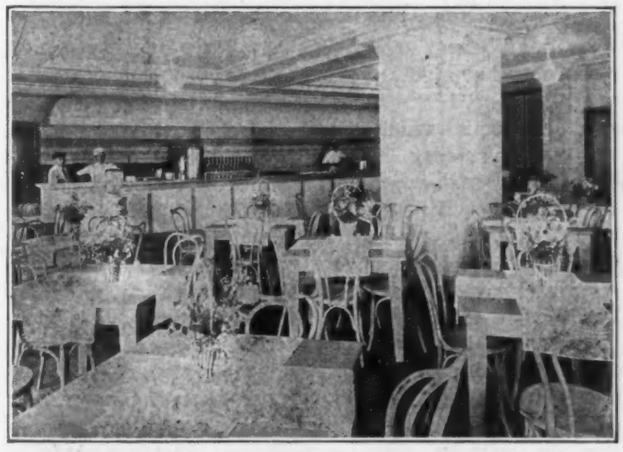
Cost of lamp (list, subject to discount)	$1.10
Cost of enameled-steel reflector (list, subject to discount)	3.60
Estimated cost of wiring per outlet	6.00
Total first cost	$10.70
Interest on investment at 6 per cent	$0.64
Depreciation on reflector and wiring at 12½ per cent	1.20
Power, at 5 cents per kilowatt-hour	12.00
Cleaning, at 3 cents per cleaning, twice a month	.72
Renewal of lamp, 2.4 per year, at $1.10	2.64
Total	$17.20
Wages for eight hours per day, 300 days, at 75 cents per hour	$1,800.00
Ratio of cost of lighting per man to wages	$17.20-1,800.00
Per cent	0.955

This table is worked up on the assumption that a 100-watt tungsten lamp, lighting 100 sq.ft., is furnished for each workman and that it burns eight hours per day for 300 days.

These figures, which are based on assumed conditions less favorable than ordinarily found, show that satisfactory lighting furnished continuously throughout the entire working day costs less than 1 per cent of a man's wages, and that if he saves five minutes' time per day owing to correct lighting the entire operating cost of the system is paid for.

Cafeteria for Company Employees

IN ORDER that its employees may obtain satisfactory lunches at a low cost, the Southern California Edison Company of Los Angeles has installed a cafeteria-type lunch room for the exclusive use of male employees. The



EMPLOYEES' LUNCHROOM, OPENED JULY 13

scale of prices for food is very low, as part of the cost is paid by the company. The arrangement provides a very good, inexpensive lunch and as it affords quick service the employees have a considerable part of their lunch hour to themselves for shopping and recreation.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

The Lighting of Piers and Warehouses. — A. L. POWELL and R. E. HARRINGTON.—The importance of adequate lighting of piers and warehouses in connection with the movement of manufacturers' products is dealt with in this article. The speeding up of shipment of goods by improved lighting is accomplished in the following ways: (1) Greater actual speed of trucking, etc.; (2) markings more easily read; (3) fewer mis-sent shipments occur; (4) reduction of spoilage and thefts; (5) improved relations with the public. Examples of good lighting of piers and warehouses also appear in this article.—*Bulletin L. D. 111, Edison Lamp Works,* May, 1920.

Light and Safety.—A. B. ODAY.—Attention is called to the large number of fatal accidents which occur in industrial plants or are due to automobiles. It is pointed out that many of these accidents might be avoided by the use of adequate illumination.—*Bulletin L. D. 112, Edison Lamp Works,* May, 1920.

Edison Miniature Lamps, Standard Versus Special.—L. C. PORTER.—A great fund of data and experience has been accumulated regarding miniature lamps for such purposes as automobile lighting, flashlamp and hand-lantern service, decorative lighting, miners' safety lamps, etc. For such service the best lamp has been worked out and standardized. These lamps are being manufactured in quantity, and they are sold at a lower price and will give more uniform performance than special lamps. It is urged, therefore, that it is advantageous to use standard lamps wherever possible. —*Bulletin L. D.* 113, *Edison Lamp Works,* May, 1920

Generation, Transmission and Distribution

A New Water-Turbine Design.—REINDL.—Systematic researches have led Dr. Kaplan to design a new type of water turbine, remarkable because of the high values of specific velocity which may be reached while maintaining good efficiency. A model turbine of 26 kw. has been tested and gave a hydraulic efficiency of 86 per cent at a specific velocity of 667 r.p.m. Even at a specific velocity as high as 1,000 r.p.m. the efficiency was about 75 per cent. The efficiency was found to remain almost constant from full to less than half load. The Kaplan turbine, it is claimed, is simple and cheap in construction, and its high velocity permits the use of small and cheap high-speed generators. The cost per kilowatt of a Kaplan turbo-generator therefore should be considerably lower than that of a corresponding set with a Francis turbine.—*Elektrotechnische Zeitschrift,* Feb. 19, 1920.

Losses in High-Tension Cables.— RENNESSON. — A special mirror wattmeter, with a silver-strip suspended moving coil and a total of 366,666 ohms in the pressure circuit, enabled the author to make rather accurate determinations of the losses at 50 cycles in a 20-m. (60-ft.) piece of 10,000-volt lead-covered three-phase cable at different temperatures and voltages. The iron sheathing was removed from the cable and single-phase voltage was impressed between the three conductors and the lead cover. The cable had a paper dielectric. It was submerged in a tank with transformer oil, and accurate track of the temperature was kept. The losses at any given temperature were found to be approximately proportional to the square of the voltage between 5,000 volts and 10,000 volts, but proportional to the 2.5th power of the voltage between 10,000 and 15,000. Runs were also made at fixed voltages while letting the cable go through very slow temperature cycles between 14 deg. C. (57 deg. Fahr.) and 60 deg. C. (150 deg. Fahr.). A decided minimum of loss was observed at about 34 deg. C. (93 deg. Fahr.), the total loss at this temperature being about 3 watts, while at 12 deg. C. (53 deg. Fahr.) the loss was about 4.5 watts, and at 60 deg. C. (140 deg. Fahr.) about 6.3 watts. The dielectric appeared to have a decided hysteretic tendency, it being impossible to reproduce exactly the loss value under given conditions after carrying the cable through a temperature cycle, however smoothly and slowly the temperature was changed. The hysteresis effect, however, being of a lesser order of magnitude than the temperature effect, did not mask the latter.—*Revue Générale d'Electricité,* May 1, 1920; also noted in *Comptes Rendus,* March 8, 1920.

Installations, Systems and Appliances

Unit Voltage Duties in Long Suspension Insulators. —HARRIS J. RYAN and HENRY H. HENLINE.—Following an elaborate study of the voltage duty of the individual units of suspension strings, which included cap and pin, bomb and link and core and tine types of insulator units, the authors state their conclusions as follows: (1) Suspension insulator units in common use can be satisfactorily employed for the make-up of insulators for 250 kv. lines. (2) Increase in the number of strings in the suspension insulator will permit the use of a limited increase in line voltage. (3) Static shields in requisite forms will lower maximum unit voltage duties so as to permit the satisfactory insulation of lines for the use of voltages far above 150 kv.—*Journal A.I.E.E.,* July, 1920.

Automatic Sectionalizing Devices.—P. CHARPENTIER. —Some time ago a number of sectionalizing devices were described by Rosebourne *(Revue Générale d'Electricité,* Nov. 29. 1919) in which the operating relays are operated by two coils or two transformers which just hold a balance when the system to be protected is working normally and currents and voltages are symmetrical. The present author deals with the same problem, but looks upon the whole question from a more general point of view. He shows how all devices operating upon these principles may be derived from the fundamental ideas of the Merz and Price protective

system. If a transmission line or a cable is to be protected the balancing coils must be put one on each end of the line, and an auxiliary cable then is used to link them up. Another way is to split the power conductor in two equal parts, using one as it were for auxiliary conductor. The wiring then may be made particularly simple, and the system may be directly applied also to direct-current installations. The tripping magnets here are provided with two opposing windings, one for each of the two parallel parts of the transmission line, thus giving no magnetical action during normal working. A short circuit, however, or a break on one conductor, would upset the balance, and the breaker would go out immediately, thus disconnecting the faulty line.—*Revue Générale d'Electricité*, April 10, 1920.

Electrophysics and Magnetism

Permanent Magnets in Theory and Practice.—S. EVERSHED.—This is an attempt to put in one paper the modern theory of permanent magnetism which will give some basis for numerical predetermination. The first part of the paper outlines the theory of permanent magnetism which is preferred by the author, and equations are given. In the second part examples of predeterminations are worked out.—London *Electrician*, May 28 and June 4, 1920.

Electric Transmission Along Non-Uniform Lines.—RAVUT.—The author considers a general case of steady alternating-current transmission along lines where the "linear constants" are no longer constant but are functions of the position along the line. The differential equations cannot be generally solved in such cases. A discussion of the properties of their solutions reveals, however, in accordance with a well-known theorem stating that every network may be characterized by three independent constants, that also in this case of a non-homogeneous line the solutions will come out in form of linear expressions for voltage and current, involving three constants, termed by the author P (propagation constant), Z (surge impedance) and S, the latter one indicating the lack of symmetry of the line. It is shown that if the ordinary home-end impedance measurements are made, with the far end freed and grounded for determination of the linear constants, incorrect values are obtained if the physical constants vary along the line. It is also shown how P, Z and S may be determined from three observed impedance values.—*Revue Générale d'Electricité*, May 8, 1920.

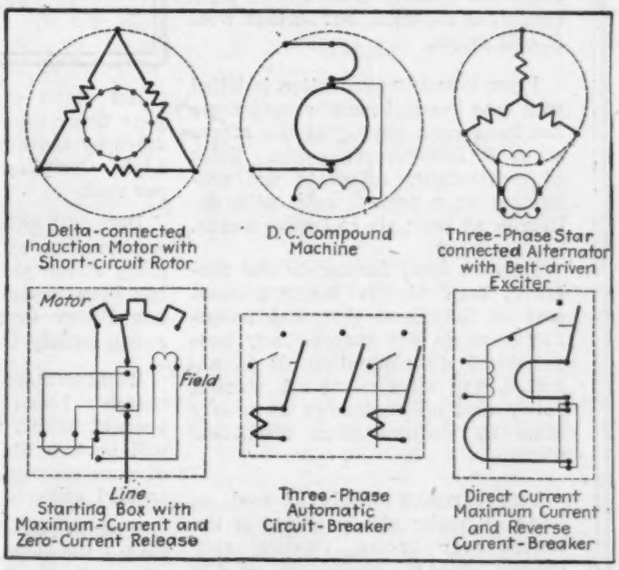
Telegraphy, Telephony and Signals

Use of Aluminum in Telegraph and Telephone Plants.—U. MEYER.—The scarcity of copper caused the German telegraph administration to investigate the possibility of using aluminum for signaling plants. Difficulties were experienced in finding methods for making reliable joints in cables, resistances of several ohms being often observed on carefully made twisted joints. For busbars, however, aluminum appeared to be just as good as copper. Telephone condensers up to 2 mf. in capacity were made with aluminum-foil and paper, with the same exterior dimensions as the ordinary tinfoil-and-paper condensers. On alternating-current tests the aluminum-foil condensers were found to have much smaller losses than tinfoil condensers, the power factor of the new condensers being only one-fifth to one-eighth that of the ordinary type.—*Elektrotechnische Zeitschrift*, Feb. 26, 1920.

Poulsen System of Radiotelegraphy.—C. F. ELWELL.—A history of the development of arc methods. Beginning with the invention by Dr. Valdemar Poulsen in 1902, the development of the Poulsen arc generator for generating undamped waves for wireless telegraphy are traced to the present state of development. It is shown that Poulsen arc stations make it possible to send messages around the world and practically to every continent. Some of the recent stations employing 250-kw. arc generators are described.—London *Electrician*, May 28, 1920.

Miscellaneous

Symbols for Electrical Machinery and Apparatus.—A. HAYET.—The conventional signs and symbols published by the *Société Française des Electriciens* in 1907 having become rather inadequate owing to the rapid advancement of the art. The author set himself the task of developing a complete system of symbols, embracing light and power installation items and also taking up signs for all such units as machinery, transformers, starting boxes, relays, fuses, automatics and hand-operated circuit breakers, etc., needed in high-power installation diagrams. All the proposed symbols may be quickly drawn with a pair of compasses, a T-square and two triangles, one 30-60-90 deg. and one 20-70-90 deg.


Delta-connected Induction Motor with Short-circuit Rotor
D. C. Compound Machine
Three-Phase Star connected Alternator with Belt-driven Exciter
Motor
Field
Line
Starting Box with Maximum-Current and Zero-Current Release
Three-Phase Automatic Circuit-Breaker
Direct Current Maximum Current and Reverse Current-Breaker

SYMBOLS FOR ELECTRICAL APPARATUS PROPOSED FOR FRANCE

For all direct-current windings the author uses semicircles, while alternating-current windings are drawn as zigzag lines with +20-deg. or —20-deg. slope with respect to the horizontal, if the length axis of the winding is vertical, and vice versa. Resistance is drawn as a rectangular zigzag line, like the oscillogram of an interrupted direct current. The article gives detailed instructions regarding best arrangement of schematic and space-true diagrams, and includes twelve pages of tracings, illustrating the new system of symbols. We reproduce here a few more complicated symbols, indicating the way to combine the elementary symbols so as to represent any particular piece of apparatus. The length of corresponding captions shows that a remarkable amount of information may be crowded into such a combined symbol, without introducing prohibitively great complications.—*Revue Générale d'Electricité*, April 3, 1920.

TRADE continues to exhibit midsummer quietness everywhere, but sales volumes are satisfactory and optimism prevails. In the Intermountain States, however, the demoralization of the wool industry has caused unfavorable business conditions, although labor troubles are less acute and a hopeful tone is evident.

EASIER transportation conditions and better deliveries are now the rule, but the car shortage in the South and Northwest is still serious and vital supplies of lumber and grain are held up. Residence construction is falling off, as money for that purpose is tight and building material high. An exception is reported in San Francisco, where more building jobs than ever before are under way. Fairly good collections are reported, and the industry is optimistic.

EAST of the Mississippi relief from the general shortage of rigid conduit is reported, but farther west it still exists.

FIBER-CONDUIT production is billed well into the fall months, and there has been good buying of the larger sizes of lead-covered cable. Sales of commutator segments are proceeding at a normal rate, with deliveries at from six to twelve weeks.

DESPITE local feeling to the contrary, both on the Western coast and in the East, electrical manufacturers do not exercise any geographical discrimination, it is asserted, and all sections are treated fairly and all customers as nearly alike as transportation conditions allow.

THE PRESENT supply of coal on hand at public utility plants is the lowest ever known, totaling only enough for three weeks and one day on June 1, the last date for which figures are available. No gain is thought to have been made since that time.

RAILROADS are refusing to assign coal cars to utilities with a surplus supply of fuel, and an order from the Interstate Commerce Commission may be necessary to adjust the situation. Some utilities with car assignments have been refused coal at the mines. The Public Service Commission for the First District of New York State has asked that the order granting priorities to public service companies, which expires Aug. 19, be extended. The N. E. L. A. has made a similar request. The I. C. C. is not in favor of broadening the order to include storage. An embargo on cross-town movement of coal cars has been asked by the American Railroad Association.

TOTAL electrical exports for the first six months of 1920, excepting locomotives, were $46,724,126, or about 4 per cent less than in 1919. Motor and generator exports were in excess of those for the same period last year, as were heating and cooking appliances.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

AN ISSUE of $2,000,000 in five-year 8 per cent gold notes is being made by the Southwestern Power & Light Company at 98, to yield 8½ per cent.

DECISION not to proceed with the construction of the proposed auxiliary steam plant at Niagara Falls has been made by the Hydro-Electric Power Commission of Ontario owing mainly to the high cost.

REORGANIZATION of the Nela Research Laboratories has been brought about, and in future there will be two divisions, a laboratory of pure science and a laboratory of applied science.

WIGGINGTON E. CREED has succeeded Frank G. Drum as president of the Pacific Gas & Electric Company.

TEN MANUFACTURERS of Shelby, Ohio, have petitioned the City Council to discontinue the municipal electric plant and purchase energy from the Ohio Light & Power Company, whose transmission lines now reach the city.

TECHNICAL, commercial, accounting and public policy sessions will make up the program of the four-day convention of the New England Section, N. E. L. A., to be held at Kineo, Me., Sept. 13-16.

CHANGES in the rules governing joint-pole use designed to remove sources of controversy have been made in the National Electric Safety Code by the Bureau of Standards.

THE N. E. L. A. executive committee will meet in New York on Sept. 1. The Public Relations Section of the association will organize next week.

ANNOUNCEMENT is made that the Federal Power Commission will be housed in the new Interior Department Building at Washington. The form of water-power permit is now being discussed.

THE TENTATIVE program for the Cleveland convention of the Illuminating Engineering Society has been issued.

ELECTROLYSIS mitigation is undergoing investigation by the Bureau of Standards.

RAPID progress in the electrification of Swiss railroads is reported.

NEW LONDON, Conn., has been selected for the thirty-fifth annual meeting of the Association of Edison Illuminating Companies on Sept. 13-16.

CONSTRUCTION work is half completed on installation of a 500-hp. Stirling three-pass boiler at the station "L" steam plant of the Portland (Ore.) Railway, Light & Power Company. This boiler will burn either "hog fuel" or oil and will serve as an auxiliary.

THE ATTORNEY-GENERAL is expected soon to announce the "fair price" for coal arrived at as a result of his investigations. Rumors that the President will appoint a fuel administrator are disbelieved.

ELECTRICAL experts in various lines will address the meeting of the National Association of Electrical Inspectors at Philadelphia on Oct. 12 and 13.

ELECTRIC service rates at the Groton (Conn.) municipal lighting plant have been reduced from 15 to 12 cents net per kilowatt-hour.

THE GROWTH of central-station service and decline of isolated-plant operations led last week to the recommendation that electrical engineers be admitted to the Universal Craftsmen Council of Engineers, which convened at Springfield, Mass.

BY THE consolidation of electric utilities on Cape Cod and Martha's Vineyard it is expected that the economic benefits of large power production at New Bedford, Mass., will be extended to that district.

A SECOND 45,000-kva. turbo-generating unit with condensing equipment has been purchased by the Narragansett Electric Lighting Company, Providence, R. I.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Form of Water-Power Permit Now Being Discussed

REGULATIONS pertaining to the form of permit to be used in applying for water-power privileges were discussed in Washington Thursday among representatives of the Federal Power Commission, the Government departments, the National Electric Light Association and various private interests.

On Friday the federal officials conferred with the representatives of Harris, Forbes & Company, the Guaranty Trust Company, the Electric Bond & Share Company, Lee, Higginson & Company, Stone & Webster and other financial interests.

The Commissioners of the District of Columbia, the Public Utilities Commissioners of Virginia and of Maryland, the Potomac Electric Power Company and others interested in the Great Falls water-power project on the Potomac have been invited to attend a hearing on Aug. 24 to be conducted by the Federal Power Commission. Each of the railroads entering Washington has been asked to send a representative to the hearing.

Utilities with Car Assignments Unable in Some Instances to Get Coal

PUBLIC service corporations are taking advantage of the Interstate Commerce Commission Order No. 9 granting them assignment of coal cars, but in some instances the order apparently is missing fire. When it was promulgated the commission did not anticipate that coal mines would be able to receive coal cars enough to take care of all of the output.

There have been instances, however, where electric light and power companies with assignment orders have been unable to obtain shipment. Two cases were reported this week, one in the Virginia coal fields and the other in the Oklahoma coal fields, where electric utilities had tried without success to obtain coal with assigned cars. In each case the utility was without contract, and the mine because it had plenty of free cars simply ignored the assigned cars.

N. E. L. A. Requests Continuance of Coal Car Priority Order

THE National Electric Light Association has been holding meetings and making a survey of the country with respect to coal supply. After a conference of the officers of the association early in the week, a telegram was sent to the Interstate Commerce Commission asking a continuance of the coal-car priority order for utilities after Aug. 19 and also requesting an interpretation of the commission's order whereby utilities will be allowed to begin laying in coal for winter storage. The telegram reads as follows:

"At a special meeting of the officers of this association held today I was instructed to wire you in behalf of the electric light and power companies of the United States earnestly urging that Interstate Commerce Commission Order No. 9 be renewed on Aug. 19 and recommending that term 'current use' be so construed that electric light and power companies may under the terms of the order obtain and have on hand at all times coal not in excess of thirty days' supply, or that the order be so modified that electric light and power companies may now begin to store coal for winter use with proper limitations, in accordance with recommendations of United States Bituminous Coal Commission. A general survey of the United States shows that electric light and power companies have been able to continue to serve the public largely because of Order No. 9, and under no circumstances should this priority order be canceled if electric light and power companies are to function through fall and winter months."

Coal Priority Order Extended Thirty Days

PRIORITY in the assignment of coal cars for public utility use was assured until Sept. 19 by the action on Wednesday of the Interstate Commerce Commission in extending its service orders Nos. 7 and 9 for a period of ninety days beginning June 21. In spite of efforts that were made to convince the commission that the order should be broadened so as to permit utilities to secure assigned cars for coal which is to be stored, the commission was apparently distinctly opposed to making such an order. It was pointed out, however, at the office of the Interstate Commerce Commission, that the public utilities are at perfect liberty to buy coal in the open market for storage purposes. The commission did not state, however, whether or not it would order the railroad to honor assignments of cars for utilities having a surplus.

Joint-Pole Use Versus Overbuilding or Conflicts

A RECENT instance of the effort of the Bureau of Standards to assure as far as possible the reasonableness of the rules of the National Electric Safety Code and to relieve them of any controversial character is its proposal to omit Rule 230d and change Rule 230c as follows:

Wording in 1916 edition, Rule 230 (old 270a)—Two parallel pole lines either of which carry supply lines (see definition 41) shall, where practicable, be so separated from each other that neither conflicts with the other. If this cannot be done, the two pole lines shall be separated as far as practicable (see Rule 245).

It is recommended that overhead lines which cannot readily be so separated from each other as not to conflict be placed on a single common-pole line unless the high voltage

of certain of the circuits or the large number of conductors makes the use of a single-pole line undesirable or impracticable.

Rule 245 contains certain special requirements where one conflicting line very closely approaches another. The bureau rearranged the rules to the extent of making the above change from Rule 270a to Rule 230c and omitted the second sentence of the first paragraph entirely. The telephone interests later requested the bureau to add another paragraph specifying certain high voltages above which joint-pole use was generally not recommended. This proposed wording was as follows:

230c—Limitation of Joint Use.—The joint use of poles by signal lines and supply lines of more than 7,500 volts (or 4,400 volts to neutral or ground) and constant current circuits of more than 10 amp. is not recommended except where it is impracticable to separate the lines sufficiently to avoid conflicts.

Between 5,000 and 7,500 volts (or between 2,900 and 4,400 volts to neutral or ground), or between 7.5 and 10 amp. for constant current circuits, conditions in particular cases will determine whether or not joint use of poles should be permitted.

This was strongly objected to by power companies, but the objections urged were not accepted by the bureau as sufficient to warrant its action until the last few weeks. Meanwhile certain minor amendments have been secured by power companies to make the recommendation against joint-pole use for higher-voltage supply lines somewhat less strong. Recent consideration by the bureau of the fact that it may in some cases be more desirable to have separate lines across a street than to have the two lines combine in one, and recognition of the fact that the wording of the rule should not be such as to permit an inference which would call for lines to be placed outside of conflict distances when joint poles are not used (which in narrow streets might drive one of the lines off the street) led the bureau to change Rule c as follows and omit Rule d entirely:

Rule 230c—Avoidance of Conflict.—Two parallel pole lines either of which carries supply conductors shall, where practicable, be so separated from each other that neither conflicts with the other. If this is impracticable, then the conflicting line (or lines) shall be built of the grade of construction required by the rules for a conflicting line or the two lines shall be combined in a single-pole line (see Rule 234).

This expresses no preference for joint-pole use as against conflict, it being expected that conditions under which preference should be shown one or the other type of construction can be worked out more satisfactorily than in the proposed Rule 230d above noted and such a requirement inserted in a future edition of the code.

Railroads Refusing Coal Cars to Utilities with a Surplus

A DOZEN or more utilities report that they have been unable to obtain coal-car assignments from the railroads because they have a surplus supply on hand. One Massachusetts electric light and power company had an eighteen days' supply on hand. Its local road assigned it cars, but the road going into the coal fields refused to honor the order. In each of the cases reported the Interstate Commerce Commission has upheld the railroads in their stand.

On the other hand, the I. C. C. has wired a number of different state utility commissions that utilities may go into the open market to secure a surplus supply of coal. In view of the above action of the railroad, however, it is doubtful if public utilities would go into the open market and purchase spot coal at prevailing prices to build up a surplus when the railroads will refuse car assignments on the basis that the utility has already a surplus.

This situation is coming before the I. C. C., and it is expected that an interpretation doing away with the equivocal condition will be made shortly.

Attorney-General's Fair Coal Price Expected Soon

ATTORNEY-GENERAL PALMER is expected to announce in a few days what he considers a fair price for coal. It was stated at his office that he is studying the returns of coal operators to the Federal Trade Commission showing production costs.

Rumors to the effect that the President had decided to appoint a fuel administrator are not being taken seriously in most quarters of Washington.

Utility Coal Supply Lowest Ever Known

STOCKS of bituminous coal held by public utility plants are the lowest they have been in the past two years, according to figures collected by the Geological Survey These figures do not include coal belonging to artificial-gas plants or railroads.

According to the figures, which are expressed in weeks' and days' supply, at the current rate of consumption at the time of stock taking the utilities had four weeks and three days' supply on hand July 15, 1918; five weeks and six days' supply, Oct. 1, 1918; six weeks and two days', Nov. 11, 1918; seven weeks and one day, Jan. 1, 1919; seven weeks and one day, April 1, 1919; three weeks, March 1, 1920; three weeks and one day, June 1, 1920.

In view of the increasing difficulties in coal transportation since the first of June there is no reason to believe that the supply on hand has increased.

New York Commission Asks I. C. C. to Extend Its Coal Order

SO THREATENING appears the fuel situation that confronts the public utilities of New York City that Alfred M. Barrett, acting head of the State Public Service Commission, First District, has sent a telegram to the chairman of the Interstate Commerce Commission asking that the order of the latter body granting priority to public utilities, which expires on Aug. 19, be extended. Mr. Barrett's telegram says that the companies are obtaining barely the absolute minimum of coal necessary to keep them going and are unable to store a pound for use in the coming winter.

Embargoes Asked on Cross-Town Coal-Car Movement

ALL carriers have been asked by the American Railroad Association to place embargoes on cross-town movements of coal cars at terminals. A permit system is recommended to take care of exceptional cases. In order to economize coal cars and to relieve congestion, it is expected that coal will be unloaded at the point where the car is originally spotted.

Edison Association Convention Sept. 13-16 at New London

THE thirty-fifth annual meeting of the Association of Edison Illuminating Companies will be held at the Griswold, Eastern Point, New London, Conn., Sept. 13 to 16 inclusive. A comprehensive program of entertainment is being arranged by the committee, including dancing, golf, tennis and other forms of amusement. A preliminary program of the business sessions follows:

TUESDAY, SEPT. 14

Morning.—President's address; report of executive committee; report of treasurer; report of committee on standards, W. C. L. Eglin chairman; report of committee on metering and service methods, P. H. Bartlett chairman; report of committee on electricity distribution and use, L. L. Elden chairman; paper, "Storage-Battery Practice in Central-Station Service," by J. Lester Woodbridge.

Evening.—Report of committee on steam turbines and generators, H. P. Liversidge chairman; address, "Turbine Characteristics," by E. W. Rice, Jr.; address, "Problems of Synchronous Operation Arising from Use of Power-Limiting Reactors," by C. P. Steinmetz.

WEDNESDAY, SEPT. 15

Morning.—Symposium on system troubles: Introductory remarks by John W. Lieb; report of committee on symposium, Philip Torchio chairman. Troubles in generating stations: Baltimore, F. E. Ricketts; Boston, R. E. Dillon; Chicago, W. L. Abbott; Detroit, G. W. Cato; New York, W. H. Lawrence; Philadelphia, N. E. Funk. Troubles on direct-current distribution systems: Boston, L. L. Elden; Chicago, D. W. Roper; New York, Philip Torchio; Philadelphia, Thomas Sproule.

Evening.—Report of lamp committee, John W. Lieb chairman; address, "Central-Station Financing," by H. M. Addinsell of Harris, Forbes & Company, followed by a general discussion by leading men of the industry; film, "Revelations."

THURSDAY, SEPT. 16

Morning.—Report of committee on rates, Alex Dow chairman; paper, "Commercial Aspects of Power Factor, Its Measurement and Correction," by C. J. Russell, discussion opened by L. L. Elden and A. S. Knight; paper, "Large Commercial Customer Problems," by E. W. Lloyd; paper, "Standard Methods of Handling Electric Welding and Furnace Loads," by C. F. Hirschfeld.

Program of Cleveland Convention of I. E. S.

FOLLOWING is the tentative program of the fourteenth annual convention of the Illuminating Engineering Society, to be held at the Statler Hotel, Cleveland, Ohio, on Oct. 4 to Oct. 7:

MONDAY, OCT. 4

Morning.—Registration.

Afternoon.—President's address, S. E. Doane; report of general secretary, Clarence L. Law; "Progress as Reported in the Literature of Illuminating Engineering," committee on progress, F. E. Cady chairman; "The Society's Educational Program," committee on education, F. C. Caldwell chairman; "I. E. S. Headlighting Specifications, Regulatory and Design," committee on automobile headlighting specifications, C. H. Sharp chairman.

TUESDAY, OCT. 5

Morning.—"Modified Views on the Theory of Light," by E. F. Nichols; "Some Applications of the Photoelectric Cell," by W. E. Story, Jr.; "Knowns and Unknowns of Light Production," by G. M. J. Mackay; "Optical Principles in Illuminating Engineering," by P. G. Nutting; "Measurements of Reflection Factors," by C. H. Sharp and W. F. Little.

Afternoon.—"Knowns and Unknowns of Illuminating Principles," auspices committee on papers; "Effect of Variations of Intensity of Illumination on Functions of Importance to the Working Eye," by C. E. Feree and Rand; "Notes on Department-Store Lighting," by J. Daniels.

Evening.—"Pleasing Proportions of Direct and Diffused Light," by J. R. Cravath; "Home-Lighting Demonstrations," auspices National Lamp Works.

WEDNESDAY, OCT. 6

Morning.—"The Problem of Brightness," by Bassett Jones; "Central-Station Methods for Securing High Lighting Standards in Stores and Homes," by O. R. Hogue, J. J. Kirk and E. D. Tillson; "Some Out-of-the-Ordinary Applications in Mill Work," by S. G. Hibben; "An Improved Method for the Illumination of Motion-Picture Theaters," by L. A. Jones; "Recent Applications of Color in Lighting," by A. D. Curtis and J. L. Stair.

Afternoon.—"The Society's Work Among Other Organizations," committee on reciprocal relations, Ward Harrison chairman; "The High Cost of Poor Lighting," by R. E. Simpson; "A New Form of Light Meter," by Davis Tuck; "Further Statistics on Street Accidents," not definitely assigned.

THURSDAY, OCT. 7

"Central-Station Experience in the Improvement of Factory Lighting," by J. B. Wilson, "Lighting of Shoe Factories," by A. L. Powell and J. H. Hurlander; address of president-elect, Gen. George H. Harries.

Additions may be made to this program, and if so they will be announced later.

Service Charge Urged in Massachusetts

REPRESENTATIVES of the principal central-station and gas plants, including municipal lighting departments, appeared recently before the Massachusetts Department of Public Utilities in support of a service charge, advocating the repeal of the existing law prohibiting the imposition of a meter charge where the consumption of energy exceeds $9 per year. E. C. Mason, Boston, pointed out that thirty-eight states now allow a service charge and with other speakers contended that only by its use can equitable rates be applied among different groups of customers.

It was pointed out that in the case of the Greenfield Electric Light & Power Company 1,061 customers use less than 8 kw.-hr. per month, or under $1 worth of energy, and that 22 per cent of the customers use only 4 per cent of the energy sold. At Newburyport 37 per cent of the customers use 5.5 per cent of the energy sold, and in Easthampton 64 per cent of the customers use 24 per cent of the energy. E. LeRoy Gardner, Chester Electric Light Company, stated that this company's average rate is about 25 cents per kilowatt-hour. All energy in excess of fifty hours' use of the demand is sold at 9.5 cents. This yields a profitable long-hour business and at the same time the short-hour customer pays only what the service is worth to him.

New Quarters for Federal Power Commission

THE Federal Power Commission will be housed in the new Interior Department Building. A definite promise of space has been made by Secretary Payne. Oscar C. Merrill, executive secretary of the commission, is expected to move his office to the new quarters next week. Major L. W. Call of the Judge Advocate General's office has been transferred to the Federal Power Commission and will serve as its chief counsel. For the present the disbursing office of the Interior Department will look after the commission's disbursements.

N. E. L. A. Executive Committee Meeting Sept. 1

THE executive committee of the N. E. L. A. will meet in New York on Sept. 1. It is anticipated that the presidents of all of the geographic divisions will be present and will bring their budgets for the year. The chairmen of the four national sections are expected at that time to announce their programs. President Martin J. Insull will announce appointments of several new committees to take up present-day problems.

New President for Pacific Gas & Electric Company

FRANK G. DRUM resigned July 30 as president of the Pacific Gas & Electric Company after holding office for fifteen years. He will still be connected with the company as a director and as a member of the executive committee. Wiggington E. Creed, attorney, president of the Hooper Lumber Company and president of the East Bay Water Company, who has had a wide experience in the public utility field, was elected president. Mr. Creed reorganized the People's Water Company of Oakland and formed the Columbia Steel Company of Pittsburg, Cal. Mr. Drum, who has been inactive for some time, gave as the reason for his resignation press of business affairs. The change in officials is said to forecast no change in the other personnel or in policy.

New England Section, N. E. L. A., Completes Program

TECHNICAL, commercial, accounting and public policy sessions will be the features of the twelfth annual convention of the New England Section of the National Electric Light Association at Kineo, Me., Sept. 13-16. On Monday evening, Sept. 13, registration and a reception will take place at the Mount Kineo House, the headquarters of the convention. At 10 a.m. on Tuesday the convention will be opened with the address of President C. R. Hayes. M. H. Aylesworth, executive manager of the N. E. L. A., will present the greetings of the parent body, and the rest of the session will include the reports of the treasurer and secretary and committee reports as follows: Accident prevention, B. J. Cook chairman; advertising and publicity, O. R. Underhill chairman; electric vehicles, Day Baker chairman; membership, J. J. Buckley chairman. In the afternoon there will be a technical session, at which will be considered reports of committees on underground systems, prime movers, electrical apparatus and overhead systems.

Accounting will be discussed at a morning session on Wednesday, the program including the report of the accounting committee, G. W. Hurn chairman, and the following papers: "Credits and Collections from a Public Service Company's Standpoint," by W. E. Dorsey; "The Importance of a Reliable Investment Account," by A. E. Lamb; "The Good-Will Value of an Efficient Accounting Organization," by I. S. Hall; "The Graphic Presentation of Statistics," by W. H. Blood, Jr.; "The Sale of Company Securities," by P. H. Whiting. In the evening there will be a public policy session, the program including an address by a public utility commissioner, a talk by a banker upon "The Financial Aspect of Public Utility Operation," and an address by Mr. Aylesworth on "What the N. E. L. A. Proposes to Do for Member Companies." Representatives of the New England public utilities commissions have been invited as guests.

Commercial matters will occupy the entire program on Thursday, the schedule following: Introduction of commercial committee's report, R. D. Cutler chairman; commercial relations division report, J. T. Day chairman; contact committee report, William Gould chairman, followed by discussion by W. F. Abely, representing jobbers, J. E. Wilson, contractors, and F. J. Allen, manufacturers; merchandising division report, R. E. Holden chairman; "The Fundamentals of Merchandising," by George H. Guest; lighting division report. C. A. Dean chairman; illustrated lecture on "Industrial Lighting," by W. D'Arcy Ryan. Afternoon session: Ranges and water-heating division report, R. J. Patterson; power division report, V. M. F. Tallman chairman, followed by a lecture by F. C. Hard, Boston, on "Industrial Heating."

Public Relations Section, N. E. L. A., to Organize Next Week

THE adjourned meeting of the Public Relations Section of the N. E. L. A. is to be held on Lake Erie on board a yacht leaving Toledo, Ohio, next Thursday, at which time all members of the executive committee, including the representatives from each of the thirteen geographic division public relations sections, will be present. The Canadian Division will be represented by D. H. McDougall, who has just been chosen chairman of the Canadian public relations section. At this meeting all of the committees will be appointed, one of the most important of which will be on organization of state committees on public utility information. It is planned to organize such a committee in every state before the end of the year. There are now eleven such state committees as follows: Illinois, Indiana, Michigan, Kansas, Nebraska, Kentucky, Iowa, Ohio, Georgia, Massachusetts and Wisconsin. These committees are going ahead on the basis that the electric light and power industry is the public's own industry. At this meeting also the entire publicity program of Director of Publicity George F. Oxley will be outlined, including the publicity through member companies, manufacturers, contractor-dealers, investment-bankers and insurance companies.

Experts to Address Electrical Inspectors

AMONG those who will address the National Association of Electrical Inspectors at its Philadelphia meeting on Oct. 12 and 13, it is announced, will be W. J. Canada, expert of the National Electric Light Association; Dana Pierce, vice-president of the Underwriters' Laboratories; A. R. Small, superintendent of label service, Underwriters' Laboratories; P. H. Bartlett, superintendent of installation, Philadelphia Electric Company; M. E. Arnold, president of the Electric Club of Philadelphia, and perhaps Dr. M. G. Lloyd of the Bureau of Standards. Many interesting points as to code interpretations will be discussed and other subjects of great importance will come up. The meeting will be held in the auditorium of the Middle Department of the association at 216 Walnut Street.

On the evening of Oct. 12 there will be a banquet, when E. J. Cattell of Philadelphia will speak

Sliding Scale of Rates Asked on Basis of Oil Costs

IN AN application to the Railroad Commission of California for an increase in rates the Western States Gas & Electric Company suggested that the commission, in granting the increase in rates asked for, should fix the rates on an elastic basis, "so that if hereafter the cost of oil is increased a certain amount the rates will automatically be increased and similarly if the cost of oil be reduced the rates will be reduced." The company asserts that such an order would obviate the frequently recurring applications for rate increases.

Swiss Railroad Electrification Near

EVERY important railroad in Switzerland will have been electrified in the near future, in the opinion of Dr. Charles Lathrop Parsons, secretary of the American Chemical Society, who has just returned from a three months' trip to Europe. He says the coal shortage has given the Swiss no alternative but to electrify the remainder of their roads and the work is being pressed vigorously. In Italy also Dr. Parsons found that electrification of railroads is being extended rapidly.

The Swiss government a month ago sold $25,000,000 of 8 per cent bonds, the proceeds to be used in this country as a part of its program for the electrification of the government railway system.

Manufacturers Urge City to Replace Municipal with Purchased Energy

TEN manufacturing establishments in the city of Shelby, Ohio, have petitioned the City Council to discontinue the municipal electric plant and purchase energy from the Ohio Light & Power Company, whose transmission lines now reach the city limits. The petitioners assert that it costs the city 4 cents a kilowatt-hour to manufacture energy, whereas it can be purchased from the power company for approximately 1.6 cents a kilowatt-hour; that it would cost no more to install the necessary equipment to bring the company's product to the switchboards for distribution than to buy new boilers now needed in the municipal plant if it is to continue business, and that the growth of the city will in a few years necessitate a new plant on a new site if the present system is to be continued—a great expense which can be obviated by resorting to the purchase of electricity.

Reorganization of Nela Research Laboratories

LARGE extensions of work have brought about a reorganization of the Nela Research Laboratories at Cleveland, Ohio. The laboratories were organized in 1908 under the directorship of Dr. Edward P. Hyde as the physical laboratory of the National Electric Lamp Association. The name was changed to Nela Research Laboratory in 1913, when the National Electric Lamp Association became the National Lamp Works of General Electric Company. For some years the laboratory was devoted exclusively to the development of those sciences on which the art of lighting has its foundation, but in 1914 the functions of the laboratory were extended by the addition of a small section of applied science, which had an immediate practical objective.

This section is now being largely extended as a separate laboratory of applied science under the immediate direction of M. Luckiesh, who became director of applied science, and a new building is being constructed to house this branch of the work, which will be carried forward with a staff of several physicists and others.

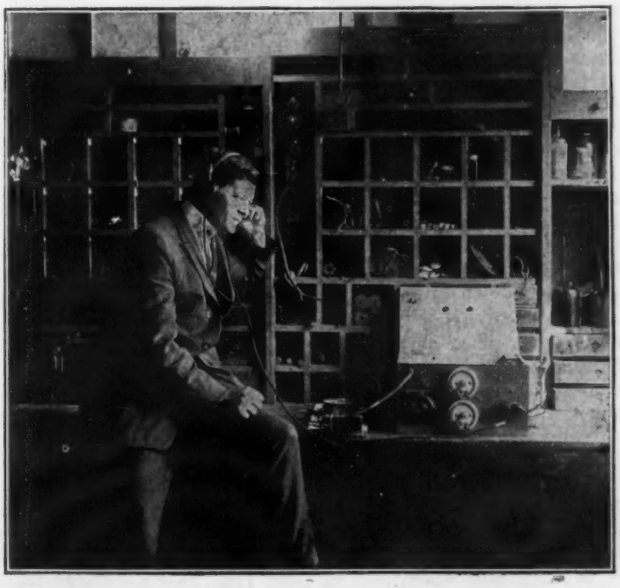
Dr. Ernest Fox Nichols, formerly president of Dartmouth College and more recently professor of physics at Yale University, will assume the immediate direction of the laboratory of pure science, under the title of director of pure science.

The laboratories of pure science and of applied science will together constitute the Nela Research Laboratories and will be co-ordinated under the general direction of Dr. Hyde, who becomes director of research.

Ways of Lessening Electrolysis Being Investigated

DURING the last four months the Bureau of Standards reports that it has carried out in co-operation with the American Committee on Electrolysis, which represents the national utility associations, a number of somewhat extended investigations in the field of electrolysis mitigation in several Middle Western cities. This work has been confined largely and almost exclusively to the effect of pipe drainage on underground systems, especial attention being given to the possibility of joint electrolysis on high-resistance joints and interchange of current between drained systems. Some attention has also been given to the three-wire systems of power distribution and also to automatic substation installations as a means of electrolysis mitigation.

Receiving a Telephone Message Over High-Tension Line



BY MEANS of directed radio or wired wireless, the American Gas & Electric Company has successfully communicated over its 11,000-volt lines between Ocean City and Atlantic City, N. J., a distance of twelve miles. The terminal apparatus may be connected with any part of the electric system—110-volt lamp socket or 2,300-volt buses. More complete details were given in the ELECTRICAL WORLD for July 17.

Madrid Has Underground Railway.—An electric underground railway, which, though less than 3 miles in length, is built according to modern specifications, has for some months been in operation in Madrid, bearing testimony to Spanish enterprise, for Madrid's population of 600,000 is less than that usually held requisite to warrant local underground passenger traffic.

Joint Outing in St. Louis.—The St. Louis Electrical Board of Trade, the Associated Engineering Societies of St. Louis, the St. Louis Railway Club and the Twelfth United States Engineers enjoyed a moonlight excursion together when they met on the steamer J. S. on the evening of Tuesday, July 27. Eighteen hundred and forty-eight members of the different organizations and their friends were present, and the combined entertainment committee provided an excellent program.

Municipal Plant Sells Out.—The village of River Rouge, Mich., has voted to sell its municipal lighting plant to the Detroit Edison Company for approximately $90,000. For this amount the Detroit Edison Company is to get the plant equipment, distribution system, etc., and a thirty-year franchise. The village had outgrown the capacity of the plant, which had been run at a loss for some time, and the municipality was confronted with the alternatives of selling the property or investing about $225,000 in order to bring the plant up to the requirements of the community.

Five-Million-Dollar Electric Pumping Plant.—At an expenditure of approximately $5,000,000, says a dispatch to the *Manufacturers' Record*, the Oil Belt Power Company is building a large electric plant about 3 miles southeast of Eastland, Tex., to supply power for oil-well pumping and the oil-field industry on a scale never before attempted. Energy will also be furnished to half a dozen towns and camps in that vicinity. Five hundred men are now constructing a dam across the Leon River and erecting the power house and transmission lines. The plant will have an ultimate capacity of 10,000 hp. A sufficient initial installation to pump 500 wells is under way and will probably soon be in operation.

Electric Heating in London.—The ever-rising price of fuel is likely, according to the *Electrician* of London, to shake the popularity of the time-honored open-grate coal fire in that city. Already the use of electric radiators in city offices has become so common that an estimate of the heating load for 1919 places it at 5,000,000 kw.-hr. In private homes no such progress has been made, and the natural tendency is to turn for relief first to gas; but the greater advantages of electricity are expected eventually to win precedence for it. For the electric companies, of course, the problem is not so much how to advertise their product as how to overcome the inherently bad load factor incidental to heating appliances.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Cemeteries and Newspapers as Utilities.—Though "public utility" is intentionally a comprehensive term in the eyes of the law, few would think of a cemetery as coming within the category. Yet in a bond suit brought by a citizen of Sapulpa, Okla., against the municipality the Supreme Court of Oklahoma has declared that a cemetery to be purchased by the city and open to public use is rightly so termed. The Public Service Commission of the state in another instance was asked to take jurisdiction of a complaint against a newspaper accused of unlawful discrimination among advertisers, but the commission held that the newspaper, not being a virtual monopoly, was not subject to its authority.

Cottages for Subway Operators.—Four cottages were recently purchased from the United States government by the Central Power Company of Newark, Ohio, for erection at the site of its substations in Mount Vernon, Lancaster, New Lexington and Logan for the use of the substation operators at those places, thus insuring the presence of an attendant twenty-four hours a day, the wife being at home while the husband is away on other duties. No rent is charged for the cottages, which contain six rooms and bath, are lighted by electricity and have hot and cold water and a furnace. They are substantially constructed and well designed. Those at Mount Vernon and Lancaster are already in place, the former being erected on an extremely high foundation as a safeguard against the flooding prevalent at that point.

Tree Trimming for a Big Electric Company.—In *Synchroscope*, published by the Detroit Edison Company, some notes have been published covering the tree-trimming operations necessitated by the system's 7,000 miles of overhead line in town and country, running for the most part along tree-shaded streets and highways and serving sixty-two municipalities. About 2,000 trees are trimmed at least once a year. As few as possible are felled. Getting permission from municipalities and private owners is no sinecure, and two instances are related in which farmers steadfastly refused to allow a branch to be touched until the company consented to cut down and convert into firewood in one case a clump of trees and in the other a single very large one, thus supplying the owners with a fine stock of merchandise—forty-five cords in the latter instance—at no cost to themselves.

Atmospheric Versus Solar Electricity.—A German scientist has a plan for utilizing atmospheric electricity by which he holds that the same land that grows food can collect electricity from the air in quantities sufficient to drive motors, thus conserving fuel while at the same time operating to protect farmers from loss by hail and lightning. This plan, attractive as it seems, has, however, to overcome the opposition of a brother Teuton who favors sun motors instead, pointing out that solar energy averages "0.8 kg. calory of power per square meter of surface per minute." Neither Herr Planson, the atmospheric pioneer, nor Herr Remain, the solar champion, can see any merit in the other's pet scheme. To the future must be left the vindication of one or both.

San Francisquito Plant No. 2 Put Into Operation. — The city of Los Angeles has recently put into operation San Francisquito Plant No. 2, which has at present a capacity of 35,000 kva. The new plant is in San Francisquito Canyon below plant No. 1 and uses water from the Los Angeles aqueduct. There are two generators in the plant, each having a capacity of 17,500 kva., directly connected by the same shaft to 20,500-hp. Francis turbines using 300 second-feet of water. The penstocks are 7 ft. in diameter, 1,430 ft. long, with a static head of 530 ft. The generator voltage is 6,600 and is stepped up through a bank of three transformers rated at 5,833 kva. to 110,000 volts. Two circuits of No. 0000 stranded copper wire about one mile in length connect the power house to the main line running from San Francisquito plant No. 1 to Los Angeles.

Rate Increases in Many Sections.—New and slightly increased electric lighting rates adopted by the gas and electric department of Norwich, Conn., are 12 cents a kilowatt-hour for the first 100 kw.-hr., 10 cents for the next 350 kw.-hr. and 6 cents for consumption in excess of that. A 20 per cent surcharge on street lighting has been put into effect by the Hartford (Conn.) Electric Light Company. The Scranton (Pa.) Electric Company has increased commercial lighting rates 20 per cent, effective Sept. 1. The Penn Central Light & Power Company has filed increased schedules for Huntingdon County, Pa.; the West Penn Power Company for Washington County, Pa., and the Philadelphia Suburban Gas & Electric Company for Chester and Montgomery Counties, Pa. The Public Service Commission of Oregon has allowed an increase in charges to the Douglas County Light & Water Company, serving electrical energy to six cities. The Public Service Commission of West Virginia has granted rate increases to the West Virginia Light & Traction Company, operating in Kanawha, Fayette and Raleigh Counties. The order granting 40 per cent increase issued Nov. 11, 1919, has been annulled, and a new order entered granting 55 per cent increase over rates in effect prior to that time.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Power-Factor Clause Approved.—The Wisconsin Railroad Commission has authorized the Burkhardt Milling & Electric Company to base its rates for electricity on the maintenance by the consumer of a minimum power factor of 80 per cent and to impose an additional charge for power factors lower than this.

Free or Reduced-Rate Service to Employees Strongly Condemned.—The Montana Public Service Commission recently declared the practice of a gas company in furnishing its employees with its product at a 50 per cent discount and its resident officials free to be "grossly discriminatory" and ordered its discontinuance.

Election Favoring Acquisition of Plant by Municipality Not Voided by Technicalities.—In Town of Milton vs. McGowan Water, Light & Power Company the Wisconsin Railroad Commission refused to declare void a municipal election that favored the acquisition by the town of a utility plant because of technical questions raised concerning the method of conducting the election, holding that there was nothing in the record to indicate that the result might have been different had other formalities been observed.

Irrigation Service as Byproduct of General Electric Service.—In establishing a power-rate schedule for the Eastern Oregon Light & Power Company and permitting it to reduce its prompt-payment discount from 10 to 5 per cent the Oregon Public Service Commission discussed the principles underlying charges for irrigation service, which it held to be rightly considered a byproduct of general electric utility service, especially so long as the demands for irrigation service do not require plant capacity in excess of that required for general service during the winter months. "Power for irrigation," the commission continues, "is, as a general proposition, in competition with gravity irrigation, and the return derived from power-irrigated lands will not justify the burden of a rate as high as that necessary for general service. The obtaining of an irrigation load at the proposed irrigation rate will, however, increase the company's revenue in a greater proportion than the increased cost of such service, and consequently the consumers of electric service as a whole are benefited by this lower irrigation rate. A seasonal minimum charge must be provided in order to insure an income on special extensions for irrigation service."

Considerations Affecting Rates of Utility Operating Several Departments.—As the result of a thorough investigation the Montana Public Service Commission granted to the Helena Light & Railway Company increases in the rates of its gas and street-railway departments while reducing the rates of its electric department. Among other principles laid down by the commission was that in ascertaining the reproduction cost of a utility operating several departments as great an allowance should not be made for the preliminary organization of each department, including the cost of procuring franchises, as if the department were owned and operated by a single utility, where all of the plants were constructed at approximately the same time and the franchises procured at the same time. The principle that where more than one utility is operated in the same community by a single company each utility must stand alone was held to be impracticable to its full extent in case of a company operating gas, electric and street-railway departments where rates of the gas and street-railway departments sufficient to earn a fair return on the investment would be prohibitive of anything like a sufficient return because the service would not be worth to the consumers the rate that would have to be charged.

Elements of Cost.—In granting to the Wisconsin-Minnesota Light & Power Company an increase in gas rates, the Wisconsin Railroad Commission made the following observations on the character of the cost incurred in rendering service to the public: "A great deal of confusion has resulted from failure to understand the nature and measure the extent of some of the elements of cost. Costs which are incurred in order that the obvious functions of the business may be carried on from day to day and for which labor and materials or other elements enter directly into the operations of the business are quite generally understood and recognized. Similarly the interest which must be paid on borrowed money is definitely measurable and not an element of cost which causes much confusion. On the other hand, such costs as that of protecting the utility against depletion of its assets due to wear and tear, or to causes such as inadequacy or obsolescence, or such costs as that of securing the capital to carry on its business, are very often misunderstood. In this case it becomes necessary to measure these costs as accurately as possible in order to fix the total cost of service which must be considered in establishing rates. Adequate provision for depreciation and adequate compensation for capital reasonably employed constitute part of the cost of service. To make the allowance for these elements either inadequate or excessive would be as unfair as to allow either less or more than the cost of labor necessarily employed in carrying on the business."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of Trial Judge in Jury Case Involving Alleged Injury from Erection of Dam.—The Supreme Court of Florida has upset the action of the court below in refusing a new trial to the Florida Power Company, against which a suit for damages from the erection of a dam was decided. The trial judge, while virtually expressing the belief that no damage to the plaintiff's property had been caused, allowed the case to go to the jury, which held differently. The Supreme Court holds that, even though he saw fit to deny a directed verdict, the judge, deeming the verdict returned to be against the weight of evidence, was in error in refusing a new trial. (84 S. 921.)

Where Facts in Damage Case Are Undisputed, Degree of Care Shown Is Question of Law.—The Southern Sierras Power Company having been mulcted in damages because of the burning of hay set on fire by sparks from a burning pole belonging to the company, this pole having become ignited through a short circuit arising from the failure of two insulators, appealed to the California District Court of Appeals. The court upset the verdict on the ground that no negligence had been shown and that where the facts in a damage case are undisputed and the course which common prudence dictates can be readily discerned the question whether a due degree of care was exercised by the defendant becomes one of law. The court held that the law did not impose the duty of an insurer upon the company and that a non-suit should have been granted. (190 P. 478.)

Recovery of Damages Denied Where Company's Negligence Was Not Proximate Cause of Injury.—In an action against the Ozark Power & Water Company for damages because of the death of a laborer who had assisted in felling a 50-ft. tree situated 40 ft. from the power company's line, this tree having in falling struck and brought down heavily charged wires with which the man subsequently came in contact, it was testified that the wires were uninsulated, the original covering having rotted away. The Missouri Court of Appeals sustained the action of the trial court in dismissing the case, holding the claim that the accident—one the electric company could not reasonably have been expected to foresee—would not have had fatal results had the wire been insulated was merely conjectural and that insulation would have been little likely to stand the impact.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

C. S. Ruffner, who took office on Aug. 1 as a vice-president of the American Institute of Electrical Engineers, is vice-president of the North American Company, with headquarters in New York. Mr. Ruffner has served as a manager of the Institute and last year was chairman of the committee devoted to the economics of electric service. Before going to New York Mr. Ruffner was located in St. Louis as vice-president and general manager of the Union Electric Light & Power Company of St. Louis, which is controlled by the North American Company. He was born in Chicago in 1880 and graduated

C. S. RUFFNER

from the University of Missouri with the degree of bachelor of science in electrical engineering. His start in engineering work was with the Telluride Power Company and the Central Colorado Company in transmission work. Since 1900, however, he has been associated with subsidiaries of the North American Company, of which he became vice-president last year.

Dr. Cary T. Hutchinson, a well known consulting engineer of New York, has been appointed a division engineer in charge of matters pertaining to railroads in the super-power zone investigation. Mr. Hutchinson was born in St. Louis and received his education at Washington University in that city and at Johns Hopkins University in Baltimore. In his early experience he was associated with the Sprague Electric Railway and the Edison General Electric Company. Later he was a member of the engineering firm of Sprague, Duncan & Hutchinson. Since 1892 he has practiced alone as a consulting engineer. He was chief engineer for the McCall Ferry hydroelectric plant of the Pennsylvania Water & Power Company at Holtwood, Pa., on the Susquehanna River. He was also in charge of the work connected with the electrification of the Cascade tunnel on the Great Northern Railroad in Washington. Mr. Hutchinson is the secretary of the Engineering Foundation and also of the National Research Council.

G. H. Hagar, until recently associated with the Vallejo Light & Power Company, has recently been made assistant division superintendent with the Great Western Power Company. Mr. Hagar will be stationed at Nappa, Cal.

Dr. E. P. Hyde, who organized the Nela Research Laboratory in 1908 as the physical laboratory of the National Electric Lamp Works at Cleveland, has been advanced, through a reorganization of that laboratory in preparation for an expansion in its work, to the position of director of research. A new laboratory of pure science and a laboratory of applied science will together constitute the Nela Research Laboratories, and the work will be co-ordinated under the general direction of Dr. Hyde. Dr. Hyde is a graduate of Johns Hopkins University, from which he also obtained his Ph.D. degree in 1904. For eight years thereafter he was connected with the National Bureau of Standards at Washington, devoting much of his attention to the photometry of incandescent lamps and supervising the design and installation of the bureau's new photometric laboratory. In 1905 he visited a number of European laboratories on behalf of the bureau to investigate photometric methods abroad, but in 1908 he resigned as as-

DR. E. P. HYDE

sociate physicist of the bureau in order to take charge of the new physics laboratory of the associated lamp interests at Cleveland. Dr. Hyde is a charter member of the Illuminating Engineering Society and served as its president in 1910.

H. F. Jackson, vice-president of the Pacific Gas & Electric Company, San Francisco, Cal., and formerly the president of the Sierra & San Francisco Power Company up to the time of the leasing of its properties by the former company, has resigned his position to become general manager of the Great Western Power Company. Mr. Jackson was born in Kansas City, Mo., in 1871, and graduated from the United States Military Academy with the class of 1896. He went to Cuba for service during the Spanish-American war and later conducted important engineering work for the government. Mr. Jackson

H. F. JACKSON

resigned from government service in 1906 and was identified with the construction and operation of the Stanislaus hydro-electric development, working up through the ranks to general manager and to the position of president of the Sierra & San Francisco Power Company and the Coast Valleys Gas & Electric Company.

R. S. Reading has been appointed electrical engineer of the Galveston-Houston Electric Railway Company, the Houston Electric Company and the Galveston Electric Company.

F. M. Roberts, formerly manager of the Keokuk (Iowa) Electric Company, has resigned to enter the coal and builders' material supply business at Port Chester, N. Y.

J. C. Thompson, secretary of the California-Oregon Power Company, will succeed George J. Walton as superintendent of the Klamath division of the company at Klamath Falls, Ore.

W. G. Hoyt, district engineer for the Geological Survey at Madison, Wis., has been assigned as hydraulic engineer to make a survey of Snake River from Huntington, Ore., to Lewiston, Idaho.

T. H. Arnold has resigned as chief electrician of the mining department of the Arizona Copper Company, Ltd., with headquarters at Morenci, Ariz., to become electrical engineer for the Southwestern Portland Cement Company of El Paso, Tex., and Victorville, Cal.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Trade Optimistic Although Collections Are Slower

IN SPITE of the stringency of credit and reports of slower collections, business conditions in the electrical industry give no cause for alarm. In fact, leading interests in the industry express very optimistic views as to the outlook for the electrical trade.

The tightness of money is causing some embarrassment to electrical jobbers because of the length of time they must wait to collect their bills, but even here the situation is not absolutely bad. Reports from the metropolitan district vary. Some jobbers express satisfaction with their accounts, others are having difficulty, but the general tenor seems to characterize conditions as fairly good.

Collections in New England are poorer, it is true, industrial customers there having gone to ninety days' payment instead of the sixty desired by leading houses. In the Middle West, however, collections, by the exercise of persistence, are remaining fairly good. In the Northwest they range from good to excellent throughout the entire district, though credit is being extended sparingly because of the fear of general inflation. On the Pacific Coast collections, while slower than last year, are not especially tight, averaging at present fifty-five days, against forty-five days for 1919. The payment of bills in the South is not proceeding altogether satisfactorily, but with the harvesting of the good cotton crop in sight money is expected to ease up. Reports from the Intermountain section state that collections are disappointing. This is proving to be a stressful period for dealers and distributers there who have large debit balances on their books, but the saving feature is the general tolerant and optimistic frame of mind that everywhere prevails.

Fiber-Conduit Production Booked Well Into Fall Months

BUYING of fiber conduit in the larger sizes has been very noticeable of late. Much of the material now going through and on order is of the 4-in. size, and some is going to 4½ in. In line with this there has been good buying of the larger sizes of lead-covered cable. At the same time it is known that as much duct ventilation as possible is desired.

Manufacturing output as a whole is booked up well into the last quarter of this year, October being well covered and much running into November. Here and there, however, a few small amounts may be taken care of late in September. At the same time, a good bit of business has been placed for 1921 delivery, and from the nature of the cable buying which has been going on this summer, it is rather expected that within the next few months fiber-conduit production will be well cared for for delivery running several months into the next year.

Demand is good all over the East and the Middle West, but there is not enough capacity to supply it quickly. The raw-material situation is in fair shape, but prices on pulp and compounds have advanced, along with the rates paid to mill workers all along the line to the finished conduit. Consequently, advances in price were made on the finished pipe during June and July, amounting to about 15 per cent. Labor is still unsteady and hard to obtain, and turnover is all too frequent. Because of this considerably more attention is being paid to the inspection of the product in its various stages of manufacture, with a consequent higher cost of production. Extra night shifts are particularly difficult to get and to keep.

Export demand is good, but shipping rates are almost prohibitive. There is not enough fiber conduit made to supply both foreign and domestic trades, so the foreign allotments are liable to suffer.

Analysis of Exports of Electric Fans for the Year 1919

DURING 1919 a total of 76,457 electric fans, valued at $1,421,160, were exported from the United States. The highest monthly value was recorded in May, amounting to $269,934. The average monthly rate of exportation was $118,430. The value of this class of exports was considerably below the monthly average during the latter half of the year, reaching the low point in December, when a value of only $32,648 was recorded.

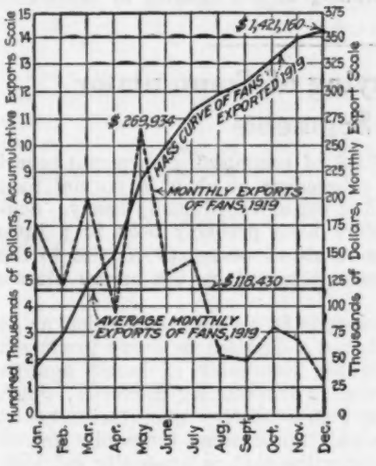

$1,421,160
$269,934
MASS CURVE OF FANS EXPORTED 1919
MONTHLY EXPORTS OF FANS, 1919
$118,430
AVERAGE MONTHLY EXPORTS OF FANS, 1919
Hundred Thousands of Dollars, Accumulative Exports Scale
Thousands Dollars, Monthly Export Scale
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

FIG. 1—MONTHLY VARIATIONS OF EXPORTS

Data compiled by the ELECTRICAL WORLD indicate that 28 per cent of this class of exports were consigned to British India, with a total of $321,901. Canada and China were second and third, with $289,319 and $277,965 respectively. Fig. 2 indicates the extent of these exports to various foreign countries. England is the only European country and Argentina the only South American country to import American fans valued at more than $25,000. The neighboring countries of Canada, Mexico and Cuba took about 27 per cent of the total exports of this class of electrical goods, valued at $389,849. Taking into consideration only such countries as imported $25,000 or more of this class of American electrical goods, continental America accounted for $480,790 worth, or about 34 per cent, and the Far East, which includes British India, China, Hongkong, Philippine Islands and Australia, took 53 per cent, valued at $752,981.

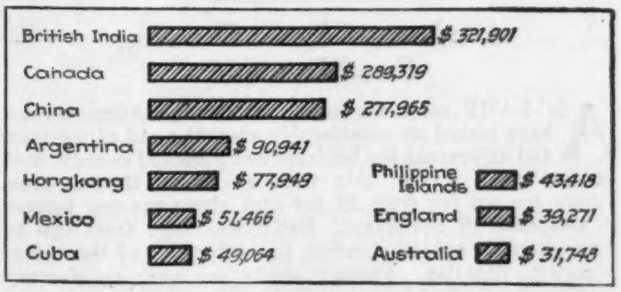


FIG. 2—ANALYSIS OF EXPORTS BY COUNTRIES

No Geographical Discrimination in Shipments

THERE is a feeling among some Pacific Coast buyers that manufacturers have been neglecting them in favor of Eastern firms, but an investigation shows that buyers in the East think it is they who are being discriminated against. During the switchmen's strike the East had some cause for complaint because the far West received more than its share of electrical apparatus from Middle Western manufacturers for the reason that railroads would not accept shipments consigned to the East. Local buyers in cities where the factories are established also complain that others are getting more goods than they. However, no one in the field seems to have been able to obtain all the supplies that were needed, and this appears to have been at the root of the trouble rather than any discrimination in favor of or against any geographical group of buyers. Furthermore, there is every indication that deliveries in most lines are improving and that they will continue to grow better for some time to come.

Almost all the principal manufacturers of electrical devices and apparatus allot a certain percentage of their output to each section of the country, and this allotment is based on the records of previous requirements. Every effort seems to have been made to treat all customers alike, and there has apparently been no idea of diverting shipments from representatives or customers on the Pacific Coast. During railroad embargoes, however, it is a case of making shipments according to the dictates of the transportation companies.

Normal Buying of Commutator Segments

MANUFACTURERS of commutator segments report that sales are proceeding at about a normal pace but that demand is not extraordinarily heavy. Segments for railway motors have probably been in a little heavier demand as the result of necessary repairs to the many motors which were damaged by the severe storms last winter.

With the supply of copper in as easy a position as at present, raw material is not a question to worry producers especially, but considerable complaint is heard against transportation as a factor in lengthening deliveries, which are quoted by several representative manufacturers at from six to twelve weeks. These same companies report a normal volume of production that is gradually catching up with those orders which in some cases have fallen behind as a result of long deliveries. No orders have been canceled, however.

Labor troubles are here and there experienced, but as a whole the situation in that respect is considered good. Prices at present are steady, and while some companies look for further increases, those that think the market will remain firm seem to be in the majority.

Collections are rather slow and accomplished with difficulty according to the credit manager of one of the largest manufacturers of this material. Public utilities appear to be the worst delinquents in this respect, but with financial relief being more and more accorded in the form of rate increases improvement is looked for.

Arc Lamps Again Showing Good Demand

ARC-LAMP sales for municipal street-lighting service have picked up considerably since the end of the war, and at present the business being booked exceeds that of last year up to this time by about 75 per cent. Prices are not far from 50 per cent above pre-war figures in this class of equipment. Deliveries range from two to three months, notwithstanding the difficulties of the transportation situation. Factory stocks are very satisfactory as regards electrodes, but the shortage of sheet iron and other sheet metal, combined with long deliveries on magnet wire, have not yet been sufficiently overcome to enable stocks to be built up in finished lamps.

A good deal of street-lighting extension work held back by the war has been carried forward of late, but it has not been brought strongly before the trade. Much interest exists today in regard to the definition of fields of maximum usefulness and economy for both arc and gas-filled series lamps, and the enormous growth of the latter in outlying-district illumination has not by any means driven the magnetite arc lamp from its position in so-called downtown lighting. Recent improvements in the manufacture of electrodes under higher pressures will soon enable their user to enjoy an increase of about 50 per cent in electrode life, and this fall it is expected that considerable new business will be developed from this source.

A noticeable increase in exports of arc lamps is noticeable in the export returns of the month of June. During that month arc-lamp material to the value of $7,743 was shipped from the country, which is more than two times in excess of that of any other month this year, and greater than that of any other month during 1919. The figure is not large, but shows that the arc-lamp export market is growing, inasmuch as the total value of exports for this class of goods was but $14,139 for the entire year of 1918 and only $16,893 in 1919.

Metal Market Situation

QUIETNESS is still the prevailing feature of the copper market, with producers holding for 19 cents, and they are apparently under no great pressure to sell in spite of the light demand. Domestic consumers are showing very little interest in future positions in the face of uncertain conditions, but small sales are being made at 19 cents for August, September and October delivery, showing that producers are absorbing the advance in freight rates which will be in effect the latter part of this month.

In the outside market sales are also light, but no great offerings are pressing. Some sales have been made at 18.50 cents, but 18.75 cents is generally asked for September and October shipments. The foreign market presents a dull tone, probably under pressure of the delicate international situation, but it is evident that no great exportation of copper will occur while the exchange rate continues so heavily against Europe as it does at the present time.

Although zinc advanced 12½ cents during the last week, no great activity is evidenced. The market is quiet but firm, with a very small amount being offered. A slightly heavier market prevails in tin, with several concerns anxious to sell for prompt delivery, but there is little demand for spot tin.

Business in old metals has been fairly good, but embargoes, freight congestion and shipping difficulties have interfered with the turnover of goods. No change in prices has been recorded the past week.

NEW YORK METAL MARKET PRICES

	August 3	August 10
Copper	£ s d	£ s d
London, standard spot	92 10 0	93 10 0
	Cents per Pound	Cents per Pound
Prime Lake	18.62½	18.75 to 18.85
Electrolytic	19.00	19.00
Casting	18.00	18.00
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.50	8.50
Antimony	7.25	7.00
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.02½	8.15
Tin	48.25	48.25
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.25 to 9.50	9.25 to 9.50
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	7.25 to 7.50	7.25 to 7.50
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

THE WEEK
IN TRADE

ALTHOUGH quieter trade is everywhere reported in the electrical industry, as a whole sales volumes are generally satisfactory and an optimistic feeling seems to prevail. The Intermountain district presents the worst business condition as a result of the demoralization of its important wool industry, but recent labor troubles in that section are subsiding and a hopeful tone is evident there. Crop prospects everywhere seem bright, and the resultant money released to circulation following harvests will mean increased electrical sales, it is expected.

Stocks in most lines are very much freer as reports of easier transportation and better deliveries continue to come in. The car shortage in the South and Northwest is still serious, however, holding up vital supplies of lumber and grain in the latter district.

Residence construction seems to be falling off in nearly every part of the country as money for construction purposes remains tight and prices of building material continue high. This condition even prevails in districts like New England, which previously had reported great building activity. As a result of this the sales of house-wiring material show some dropping off, though an exception to this rule is found in San Francisco, where the number of jobs under way is greater than ever before.

A break in the general shortage of rigid conduit appears as territory east of the Mississippi reports signs of relief, but points further west are still meeting famine conditions.

NEW YORK

Uneven trade conditions are reported in the electrical business the past week. Several jobbers say that their business is as good as it ever has been and that they have as yet experienced no let-up. Others, however, are finding a considerably slackened volume of trade, and one representative house even characterized the situation as "rotten."

Stocks, however, in general are undoubtedly improving in the face of lessened demand and more regular shipments, but certain items, such as pipe, porcelain and some of the steel material like outlet boxes, are still very short.

The lack of residence construction is having its effect uopn the electrical trade though the big contractors are very optimistic. House construction represented only 18 per cent of the total building contracts for July in this district, which is a large decline from the figures for the month of June.

Transportation has eased up to some extent, although jobbers are still complaining about both incoming and outgoing shipments. No trouble is experienced with express shipments, however. Orders that are now being delivered are mostly ones which have been on the books for a long time.

Stocks of flexible armored conductor are much better, and the rigid-conduit supply also shows some slight signs of improvement. A shortage of heating appliances and flush switches is looked for in some quarters later on.

Outlet Boxes.—Some shortage is reported in the face of a good demand with very low stocks the rule. Shipments are irregular.

Metal Molding.—This is in fair demand and stocks seem to be in good shape. Certain fittings are not so plentiful as the molding itself.

Rigid Conduit.—The situation is undoubtedly bad, but some signs of easing up are appearing. One jobber has a large stock and another is almost overstocked on small sizes of black conduit. Shipments are very irregular, however, and where any stocks exist they are mostly light. Demand holds up well. Prices for ½-in. black range from about $90 to $105 and for the ¾-in. black from $128 to $135 per 1,000 ft.

Knife Switches.—Demand in general seems to be off though some jobbers report a good call. Fairly good stocks are on hand. Shipments for some are coming in well and others are reported poor.

Flexible Armored Conductor.—The trade continues to find a much easier situation here. Demand has slackened and shipments are a bit more regular, although here and there jobbers are still short, but on the whole fair stocks are accumulating. From around $110 to $115 is being quoted, though in one case the price ranged as low as $105 and in another as high as $121 per 1,000 ft.

Weatherproof Wire.—An easy supply is reported, with good stocks and no difficulty as to shipments. Demand is only average. A representative firm quotes No. 14 at about 60 cents a pound.

Sockets.—One jobber has no stock of any type, and though another has been short on keyless, stocks on the whole seem to be substantial and able to fill the fairly good demand without difficulty.

Heating Appliances.—Shipments are very slow and irregular, back orders of six and seven months' standing just arriving for some jobbers and easing up present supplies, but a big shortage seems to be generally anticipated for the holiday trade. A good summer demand is reported.

Fans.—A few jobbers who stocked light are jubilant over prospects of emptying shelves, but by far the majority will have to carry over a great many more fans than they would like to.

Flush Switches.—In some quarters a scarcity is looked for this fall, but at present stocks are good and demand fairly steady though some jobbers are finding it light because of the dearth of residence construction.

Heaters.—Some jobbers are already stocked up, but others are holding off ordering to see how the coal situation breaks and because of the uncertainty of the weather outlook.

CHICAGO

There are no present indications of any real resumption of the construction industry in this section. Permits issued during July totaled only $6,700,000 and for the first week of August $841,000. Architects and engineers are one in stating that they have many jobs "on the boards," but they are uniformly delayed pending arrival of more favorable conditions.

Jobbers are busy, and with the easing up of traffic conditions, which now so far as the movement of freight is concerned are approaching normal, considerable supplies of all materials are being received and orders long on the books are being filled. Inquiries continue numerous, but the actual placing of orders is light compared with business in the spring. There is considerable difficulty experienced in obtaining cars, but with the speeding up of cars in transit this condition should improve, and many interests that were seriously inconvenienced by shipping delays now announce themselves in better condition. Price conditions are stable, no changes of moment being noted.

Wire.—Difficulty on the part of manufacturers in getting cars has led to a reduction in stocks in the local market. Deliveries have been considerably slowed up thereby, bare copper requiring up to thirty days. Prices, while unchanged, are very firm, and the feeling is that a slight advance may be looked for soon.

Galvanized Strand.—The shortage in this commodity is severe, local stocks being practically exhausted. It is impossible to obtain definite promises of delivery and prices have been withdrawn, orders being booked for the price ruling at time of shipment.

Rigid Conduit.—Receipts have fallen to a minimum in the last week and deliveries are made uncertain thereby. Factories report ample supplies, and upon the relief of freight car troubles local supply conditions should be speedily improved.

Line Material.—The car shortage has curtailed receipts, but rate increases have put many utilities in the market for material and inquiries are now very brisk. Line hardware and porcelain insulators are almost unobtainable, while poles and cross-arms are scarce on account of shipping troubles. Locust pins are obtainable with less difficulty.

Schedule Material.—Stocks are well maintained, principally owing to light demand, as new construction work is off. Rosettes, sockets, etc., are obtainable from stock and receipts from factory are ample.

Heating Appliances.—Warmer weather has improved retail sales and jobbers are all busy in filling back orders. New orders do not amount to much at present. Some concerns report cancellations from industrial centers which have experienced industrial depression, but such cancellations do not amount to any great sum.

Ranges.—Much interest is being displayed by the country trade, particularly in the Northwest, in ranges for fall delivery. Fair stocks are held in Chicago, but at the rate orders are being placed deliveries will soon have to lengthen.

High Tension Equipment.—New discounts on unit-type high-tension Delta-Star Electric Company equipment are covered by discount sheet No. 14, dated Aug. 1. Prices have advanced approximately 10 per cent.

BOSTON

Quieter business marks the mid-vacation season in trade. The larger jobbing houses report well-sustained buying, but the smaller establishments note a decided curtailment. Stocks are gradually increasing in size, except in porcelain material and motors. Building and engineering contracts in New England to Aug. 5 this year total $210,835,000, compared with $113,087,000 for the same period last year, but recent contract totals do not maintain this increase. Contractors are very busy on industrial wiring. The appliance business is relatively quiet. A new seven-hundred-thousand-dollar telephone exchange will be built in Boston shortly, and a large amount of manufacturing plant extension work is being carried forward at present.

Fans.—Notwithstanding recent extremely hot weather jobbers' stocks of fans are still unexhausted. Poor fan weather early in the season is responsible. A representative make sells at $42 list in the 16-in. oscillating type and $37 list in the 12-in. size, a discount of 25 per cent being given dealers on lots of twelve.

Motors.—Increased manufacturing facilities combined with a slight recession in demand are enabling stocks to be built up to a small degree in some of the smaller sizes. On alternating-current motors of 1-hp. to 10-hp. rating a leading agency quotes deliveries of twenty-eight weeks' average. On direct-current motors twenty-two to twenty-four weeks' delivery is quoted. Prices are steady.

Wire.—Stocks are now well built up, although magnet wire is still very difficult to obtain. Rubber-covered wire, No. 14, sells for $11 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is 29 cents, with bare base 24 cents.

Non-Metallic Flexible Conduit.—Prices are easier, the ½-in. size selling this week for $33.50 per 1,000 ft. in 1,000-ft. lots and the ¾-in. size at $36.50. Buying is falling off somewhat. Stocks are reasonably full.

Porcelain Tubes.—All porcelain material is very scarce. When obtainable 3-in. tubes are quoted at $11.35 per 1,000 in barrel lots.

Rigid Conduit.—Conflicting reports are received as to the supply, but in general some improvement can be seen. Stocks are spotty. Substitutions are frequently necessary in order to complete jobs, one contractor having used 2-in. and 4-in. elbows in face of a shortage of 1¼-in. units last week. Occasional carload shipments are being received and old customers' orders are being filled in this way as far as possible.

Storage Batteries.—Trade continues brisk, with firm prices and good local stocks. A leading distributer reports increased business over last year and is making excellent deliveries as a result of forehanded shipments.

Ranges.—The demand holds up well, despite the lack of any concerted sales campaigning in retail circles. Shipments from factory stock can be obtained on a representative well-established design, while three months' delivery is quoted on a design specially suited to apartment-house service. Raw material is coming to hand in relatively larger quantity than hitherto.

Flatirons.—A sustained demand is being experienced. A leading factory is still considerably behind on orders, but is getting out production on a very satisfactory basis.

ATLANTA

Underlying business conditions throughout the district showed little change during the past week, and jobbers report a continuation of the dullness that has been referred to heretofore. Business conditions, however, are in a healthy state, and the slump of orders is largely to be accounted for by the summer season. Building permits for Atlanta for the month of July were $1,608,000, as against something over $2,000,000 for the month of June; but construction in the smaller cities shows an increase for the month of July. Agricultural reports for the section show that all crops are in excellent condition, and the outlook throughout the rural district is very bright, provided that there is not an unusual spell of bad weather between now and fall.

Jobbers report an improvement in the receipt of material, and this, together with a general slackening of orders, is permitting the accumulation of small stocks in some classes of material. The congestion in transportation is still acute and is interfering materially with the completion of buildings under construction. Of course this is holding off the installation of electric wiring and apparatus and contributes its share to holding down the receipt of orders.

Metal Molding.—Difficulty in obtaining rigid conduit has served to stimulate the movement of metal molding, though it has not become so popular as the shortage in rigid conduit would have led one to believe. Stocks are reported on hand in sufficient quantities to meet all reasonable demands.

Rigid Conduit.—The situation is reported as considerably better than for some months past, fair stocks of some sizes being on hand. Great difficulty is experienced, however, in obtaining galvanized pipe straps; in fact, there are no stocks in the territory and jobbers can offer no hope of an early relief.

Lamps.—Dealers are placing orders for fall stocks in very fair quantities. One of the largest jobbers predicts that considerable difficulty will be experienced in meeting the demand, insufficint quantities of 100-watt type C lamps already being reported.

Wire.—Several very large shipments of wire were received the past week and stocks are in fair shape. A sharp break in wire prices is to be noted, in one or two extreme cases weatherproof being quoted on 26½ cents base; rubber-covered, 30 cents base. The demand is holding up well in all sizes.

Safety Switches.—The tendency to substitute this device for the old open type is on the increase and demand continues very brisk as a result. Deliveries have been coming through satisfactorily and stocks are reported in very fair condition. A price advance of approximately 10 per cent on sizes of 60 amp. and over is to be noted. In quantities of $600 two-wire, 30-amp. are quoted at $1.77; three-wire, $2.65.

Flexible Non-Metallic Conduit.—There is still a shortage, though jobbers are expecting to receive a large supply in the near future. The demand continues very brisk with quotations for ⅜-in. at $4.62 per 100 ft.; ½-in., $4.24 per 100 ft.

Fuses.—A normal movement is reported, with stocks in fair condition throughout the territory. There is a very general shortage of plug fuses in 15-amp. sizes. Prices, plug fuses, lots of 500 and over, 5 cents each.

Flexible Armored Conductor.—There has been little let-up in demand, and poor shipments have prevented the accumulation of any stocks. Such supplies as are received are redistributed on an allotment basis. Prices on two-wire, No. 14, lots of 1,000 ft. to 2,500 ft., $11.60 per 100 ft.

SAN FRANCISCO

The contractors' committee is still considering the request of the electrical unions for higher wages. It is claimed that $10 a day for electricians and $9 a day for fixture hangers will add appreciably to the cost of jobs and that the public will hesitate about paying the increases. There are more large jobs under way at present than there have been in many years, and other work also continues brisk. The value of the building permits issued in the three principal California cities for July, 1920, is: Los Angeles, $5,121,000; San Francisco, $4,311,000, and Oakland, $1,374,000. The 1919 figures were respectively $1,887,000, $1,832,000 and $596,000. While freight shipments from the factories are slower than they were last year they are more regular and stocks are in better shape than they have been for some time.

Sewing Machines.—Higher retail prices for garments have caused a noticeable increase in the sale of sewing machines. As an evidence of better merchandising ability on the part of electrical dealers it is reported that jobbers have surplus stocks of the cheaper vibrating types, whereas they are constantly short of the higher-priced rotary styles.

Flashlights.—During the last week of the Everyready picture title contest it was reported that a total of more than 1,000,000 blanks and 500,000 miniature pictures had been distributed along the Pacific Coast, with gratifying sales by jobbers and dealers alike.

Batteries.—Although various causes are gradually cutting down the sale of single dry batteries there is a marked increase in the sale of manufactured combinations of batteries such as the "Hot Shot." Wherever dealers have displayed such lines a good increase in orders has resulted.

Farm Plants.—Well-advertised affairs to be held during the autumn will give exhibitors splendid opportunities for demonstrations of various types. Annual fixtures such as the Sacramento State Fair in September and the Fresno County Fair in October will result in many sales, it is expected.

SEATTLE—PORTLAND

Practically the same conditions in the electrical business as outlined for several weeks past still obtain in Seattle and the Puget Sound territory. In towns and communities in this district, except Seattle, sales volumes, generally speaking, are satisfactory. In Seattle, however, sales continue on the decrease, and this applies to nearly everything electrical that is sold. Especially is the decrease noted in the movement of schedule materials owing to the dropping off in residence building. With but one or two exceptions stocks are in good condition and are improving daily. Shipments from Eastern factories are much freer, enabling jobbers to fill all demands and still build up stocks. Since the price increase of recent date, touching nearly every line, prices have been holding firm at a new high mark. Signs of resumption of building activity on a large scale have been noticed the past week. At the present time every available freight car on the Northern Pacific system is being sent into the Northwest in order to give relief to lumber operators and permit them to ship all unfilled orders before the new advance in freight rates becomes effective the latter part of this month. Nearly all lumber mills and logging camps in Oregon and Washington which were closed down for repairs early in July are now operating again, many of them running two shifts. There is a scarcity of labor in the camps but mills seem to be fairly well supplied.

Schedule Materials.—With the exception of a very few items comparatively satisfactory stocks are reported in the Puget Sound district. Seattle jobbers as a whole have large stocks owing to the decreasing demand the past month. Shipments are coming through satisfactorily and prices hold firm.

Small Motors.—Hope for relief has been given up entirely. Demand is constantly increasing and is very strong from fruit canneries, garages and small industrial plants.

Lamps.—Practically every concern in the Puget Sound district reports excellent stocks in all sizes. However, this is the off-season and demand is negligible, mainly for replacements.

Flashlight Batteries and Lamps.—The usual vacation season demand is being met with no particular difficulty. Stocks, generally speaking, are in fair shape and shipments are coming through satisfactorily.

Fuses.—Seattle jobbers report ample stocks for a demand which is below normal and decreasing gradually. What call there is is about equally divided between renewable and non-renewable types. Shipments are good and prices steady.

Conduit Fittings.—With the exception of some few items which are short owing to raw-material difficulties, stocks are in fair shape. Demand is only fair. Prices are fluctuating, but no particular change is noted.

Switches.—In the face of sub-normal demand which shows no great sign of improving stocks of snap and push-button types are in good shape. Stocks of knife switches are ample to care for the light demand.

Ranges.—Both central stations and jobbers report that demand for ranges continues strong in spite of recent advances in price and the fact that no campaigning is being carried on. There is a shortage in nearly all types. Deliveries are far from satisfactory.

SALT LAKE CITY—DENVER

The demoralization of the wool industry is having a serious effect on merchandising conditions in the Intermountain States. Millions of dollars that would normally be in circulation from this source must this year be counted lost. This is one of the big contributing causes to the semi-slump that now exists, as a setback to the wool industry has a far-reaching effect on commerce and trade.

Transportation continues slow and uncertain. Eight to nine weeks are required to get shipments from Eastern factories, though deliveries are improving. A serious congestion of freight is anticipated next fall when the increased freight rates take effect. Factories are urging jobbers to place orders for immediate deliveries to obviate being caught in the probable rush.

Building and construction show little improvement. A lot of big construction is projected, but just now deferred operation is the rule. It is next to impossible to obtain money for any sort of building activity. Labor troubles, too, have a deterring effect. The situation there, however, is improving. It is conceded that the unions have lost in their fight against the "American plan" and that hundreds of union men are going back to work. Much delayed construction will now be resumed.

With the beginning of the crop movement there is a slight indication of improvement in general market conditions. It is believed that the big and real alleviation will come with the harvesting of the sugar-beet crop, which puts in circulation many millions of dollars. Electrical merchants are optimists. Despite the handicaps under which they are operating just now they foresee better days soon.

Fans.—At the closing of the active fan season jobbers report little stock on hand. The demand has shown a marked decline in the past week as there is little market for fans here after Aug. 1.

Porcelain and Pole-Line Hardware.—Extreme difficulty is experienced in getting deliveries. Shortage of factory labor is given as the cause. Several big construction jobs are under way in the Mountain States, and there is consequently a big demand for these lines.

Rigid Conduit.—No stocks are available. The condition seems general, and appeals to jobbers for release of their contracts at a premium are being received from points as far away as Cuba.

Rubber-Covered Wire.—There is a decided shortage here. Jobbers are looking forward to an advance in price.

Steel Plates.—Material for switchboards is almost impossible to get. Factories are away behind in their orders.

Lamp Cord.—The lamp-cord situation is decidedly bad. Many dealers are cleaned out, with small prospect for delivery in the future.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Prepayment Attachment for Watt-hour Meter

For supplying energy to small consumers and a shifting population, the type OA prepayment attachment for type OA single-phase watt-hour meters has been manufactured by the Westinghouse Electric & Manufacturing Company. The meter may be changed back to standard by replacing the

PREPAYMENT UP TO SIXTEEN COINS MAY BE USED

standard register and cover. The attachment mechanism is mechanical and operated by a 25-cent piece. The turning of a knob winds a spring which is unwound by the gears at a speed depending on the rate per kilowatt-hour for which the attachment is furnished. From 4-cent to 25-cent rates, full-cent values, may be used. Integrating dials may be attached.

Electrically Operated Advertising Sign

For displaying advertising cards in shop windows, a motor-driven card-display machine is being manufactured by the United Advertising & Sales Company, San Francisco, Cal. Twenty-four cards of standard street-car size can continuously rotate in this machine, individual cards sliding into view at definite intervals. Chains at both ends are driven by a Westinghouse type CA, 1/20-hp., 110-volt, 1,750-r.p.m. motor through a horizontal shaft, worm gear and belt.

Clothes Washer

A new reversing, revolving-cylinder-type washing machine, the Rotapex, has been placed on the market by the Apex Electrical Distributing Company, Cleveland, Ohio. The Armco iron or copper cylinder is driven 23 r.p.m. and reverses once in every five and one-half revolutions. An 11¾-in. power-driven, safety-release wringer is used, and the ¼-hp. inclosed motor is ventilated. The machine occupies 26½ in. by 25½ in. of floor space.

Audion Control Cabinet for Radio Work

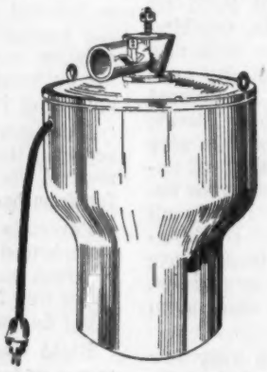
The audion control cabinet, type A1, made by the K. & G. Wireless Supply Company, 152 Chambers Street, New York City, measures 8 in. x 5¾ in. x 6 in., is of mahogany finish, and contains the following instruments: Vacuum tube receptacle, filament rheostat, grid condenser, grid leak and filament switch. The tube receptacle will take any standard four-prong bulb. The plate-battery space is designed to take two batteries of the standard 22½-volt type. The filament rheostat is interior-mounted and adapted for either 4 volts or 6 volts.

Electro Trouble Detector for Automobiles

An instrument for measuring current and detecting trouble in the electrical apparatus of any make of automobile is being marketed, under the name of "Hyrate," by the Service Station Supply Company, 30 East Larned Street, Detroit, Mich.

Player-Piano Power Plant

A motor unit, known as the "Aerex," which can be attached to any player piano to play electrically, has been put



ELECTRIC PIANO MADE FROM MECHANICAL PIANO

on the market by H. W. Yeager & Company, Inc., 154 North Eleventh Street, Philadelphia. After the device is installed, it is necessary only to connect the piano to the house circuit by a cord. Control is by push button. About 100 watts is consumed in operation.

Automatic Safety Bowl Heater

For guarding against danger of fire or scorching, a new heater is being brought out by the Edison Electric Appliance Company, Inc., New York City, with certain safety features. An automatic gravity switch is mounted in the base of the heater, and when the latter tips over, face down, the switch disconnects the circuit. When the heater is righted the current is automatically turned on again. The bowl is also so hinged that it cannot be

CURRENT DISCONNECTED IF HEATER FALLS OVER

tipped down far enough for the heat rays to strike the floor. In the Hotpoint line the heater is called the "Hedlite-Automatic," and in the Edison line the "Edison Glow-Automatic."

Battery Testing Voltmeter

A battery-testing voltmeter (model No. 443), designed for the car owner, battery service station and garage men, has been developed by the Western Electrical Instrument Company, Waverly Park, Newark, N. J. Features of the instrument are its compactness, acid-proof case and legible scale. In addition to its normal scale of zero to 3 volts, the instrument is calibrated so that part of the scale (to the right and left of zero) is specially divided for making the cadmium test.

Notes on Recent Appliances

Time Clock

The Warren time clock, a synchronous motor operating a clock movement to compare speed of synchronous generator with exact time, is being manufactured by the General Electric Company.

Electric Drier

An electric shoe sole drier is being manufactured by the S. U. E. Company, 89 Beach Street, Boston, Mass.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE PORCELAIN INSULATOR CORPORATION, Lima, N. Y., recently incorporated with a capital stock of $250,000, is planning to erect a new plant on the old site of the plant of the Locke Insulator Manufacturing Company, which was destroyed by fire more than a year ago. The new company will manufacture high-voltage porcelain insulators and electrical appliances, starting with a four-kiln capacity. It is expected to have the plant in operation by January, 1921. W. F. Harvey is president, D. H. Finucan vice-president, B. A. Plimpton secretary and V. E. Taylor Treasurer.

THE REPUBLIC ELECTRIC MANUFACTURING COMPANY, 1820 East Eighteenth Street, Cleveland, Ohio, will soon open bids for the erection of a three-story factory and office building, 50 x 50 ft., on East Eighteenth Street and Chester Avenue, to cost about $100,000. L. Griesser is president.

THE EXIDE BATTERY COMPANY, 5125 Perkins Avenue, Cleveland, Ohio, has awarded contract for alterations to factory, to cost about $60,000.

THE OHIO ELECTRIC CONTROLLER COMPANY, 5900 Maurice Avenue, has awarded contract for erection of an addition to its factory, to cost about $60,000.

THE DETROIT INSULATED WIRE COMPANY, Wesson and Albert Streets, Detroit, Mich., has awarded contract for erection of a three-story addition to its factory, 40 ft. x 80 ft., to cost about $80,000.

THE FRANK ADAM ELECTRIC COMPANY, 3640 Windsor Place, St. Louis, has awarded contract for erection of a one-story factory building, 147 ft. x 190 ft., to cost about $150,000.

B. F. RUREY, formerly in charge of the electrical department of the George H. Smith Steel Casting Company, Milwaukee, Wis., has been appointed electrical superintendent for the Milwaukee Rolling Mills Company, which was organized about a year ago. Mr. Rurey has been engaged in electrical maintenance and construction work for the past ten years.

THE ELECTRICAL MATERIAL COMPANY, 622 West Jackson Boulevard, Chicago, has established an appliance department for handling a number of electrical household appliances, including Torrington cleaners and the Rutenber products. The company has also taken over the distribution of the "2-in-1" washer manufactured by the Minier (Ill.) Manufacturing Company in Michigan, Indiana, Illinois and Iowa. Charles E. Kile is in charge of this department.

THE O'ROURKE CRANE & ENGINEERING COMPANY, 366 Fifth Avenue, New York City, recently incorporated, will establish a plant at Hudson, N. Y., for the manufacture of overhead electric traveling cranes, derricks and hoists for industrial plants, docks, terminals, etc. F. E. O'Rourke is president and general manager, P. R. Moses vice-president, and John N. Trainer treasurer.

THE ELECTRIC STORAGE BATTERY COMPANY, Nineteenth Street and Allegheny Avenue, Philadelphia, has filed plans for its proposed new plant at Rising Sun and Adams Road. Seven buildings will be erected, to cost about $224,000. The company recently increased its capital stock by $12,000,000, of which a large portion will be used for expansion.

THE AMERICAN BOSCH MAGNETO CORPORATION, Springfield, Mass., shows that sales at present are running at the annual rate of about $12,000,000, compared with about $6,000,000 in 1919. In the five months ended with May 180,000 instruments were shipped by the company, whereas in the entire year 1919 the total output was 207,000 instruments. Unfinished orders at the end of May, 1920, totaled $8,000,000, which shows a substantial increase over the $7,000,000 of unfinished orders held at the beginning of February, 1920, the increase being at the rate of $3,000,000 per annum.

EDWARD W. HARRY, electrical engineer of the National Tube Company, McKeesport, Pa., left the electrical department on July 17 to become chief electrical engineer with the Pittsburgh Steel Company at Monessen, Pa., Mr. Harry started with the electrical department in 1910 as a lineman and while there took a course in electrical engineering in the Carnegie Institute of Technology, from which he was graduated in 1915.

THE MERMAID ELECTRIC DISHWASHER COMPANY, Middletown, Conn., announces that H. W. Karstens has been appointed sales manager. Previous to joining the Mermaid organization Mr Karstens was sales manager of the electrical jobbing house of the Elliott-Lewis Company, Philadelphia. His earlier experience was gained with the Franklin Electric Manufacturing Company and the Holophane Works of the General Electric Company, for both of which he traveled in the western states.

L. D. DUNTLEY has become associated with the Black Swan Company, 1100 Marshall Street, Minneapolis, Minn., where he will assume active management of sales. He was formerly general sales manager of the Bluebird Appliance Company, St. Louis, Mo.

HENRY PRICE BALL has become consulting engineer of the Redtop Electric Company, 8 West Nineteenth Street, New York City, manufacturer of elctric stoves. Mr. Bell was for several years with the General Electric Company as engineer of the electric heating device department.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York City, has purchased a site on Arlington Avenue, Bloomfield, N. J., directly opposite the Watsessing branch of the company. The site consists of 2.6 acres and will provide for future extensions.

RALPH B. COLEMAN, formerly of the Chicago offices of the Maloney Electric Company, has joined the sales forces of the Consolidated Wire & Machinery Corporation, 519 West Van Buren Street, Chicago. Mr. Coleman has been in the West for the past twenty years and has a wide acquaintance among central-station men in that section.

BERT ROTH, formerly the Yale Electric Company, West New York, N. J. announces the removal of offices to 98 Springfield Avenue, Newark, N. J., where he will continue in electrical advertising business.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY, 2700 East Seventy-ninth Street, Cleveland, Ohio, has opened a new office in the Witherspoon Building, Philadelphia, in charge of H. K. Hardcastle.

THE DETROIT INSULATED WIRE COMPANY, 641 Wesson Avenue, Detroit, has awarded contract for a one-story addition to its plant.

THE WESTERN AUTO ELECTRIC COMPANY, Los Angeles, Cal., has completed plans for the erection of a two-story plant, 141 ft. x 155 ft., at the corner of Sixteenth and Hope Streets. The company manufactures electrical accessories for automobiles.

DEWEY, STRONG & TOWNSEND, Crocker Building, San Francisco, Cal., announce the entry of William A. Loftus, Thomas Castberg, James M. Abbett and John H. Herring into the firm, which will be known as Dewey, Strong, Townsend & Loftus. Mr. Herring will have charge of the trademark and foreign department; Mr. Abbett will specialize in chemical and electrical patent matters; Mr. Castberg will devote his attention to engineering and industrial cases, and Mr. Strong, after more than fifty years of active practice, will retain his association in an advisory capacity.

THE STUART PRODUCTS CORPORATION, manufacturer of batteries, is now established in its new quarters at 665 Washington Boulevard, Chicago. The company has organized a sales promotion department to co-operate with its jobbers and dealers.

WESTINGHOUSE CHANGES. — The Westinghouse Electric & Manufacturing Company announces that L. D. Canfield, assistant district service manager at the New York office, has been appointed district service manager to succeed L. G. Richards, who has been transferred to East Pittsburgh. G. O. Noble has been appointed special representative, and R. A. Hopkins, manager of the power and marine division in the Los Angeles district office of the company.

THE BENJAMIN ELECTRIC COMPANY, Chicago, is planning to erect a one-story power house, 77 ft. x 147 ft., at its Desplaines plant. The company is offering for sale $1,500,000 in 8 per cent gold notes, the proceeds to be used to take up outstanding indebtedness to banks.

HARVEY HUBBELL, INC., Bridgeport, Conn., has filed plans for the erection of an addition to its plant, one-story, 80 ft. x 85 ft., with wing extension, 46 ft. x 80 ft.

LANDERS, FRARY & CLARK, INC., New Britain, Conn., have filed articles of incorporation under the laws of the State of New Jersey with a capital stock of $6,000,000.

THE CHAMPION IGNITION COMPANY, Flint, Mich., has completed plans for the installation of a new power plant at its works, to cost about $60,000.

THE SANFORD RILEY STOKER COMPANY announces the removal of its Worcester (Mass.) office from 25 Foster Street to 9 Neponset Street.

THE CHICAGO PNEUMATIC TOOL COMPANY, Chicago, announces that, effective Aug. 1, its publicity department will be in the Chicago Pneumatic Building, 6 East Forty-fourth Street, New York City.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has purchased from the State of New York a section of the old Erie Canal bed, about 3 miles long, extending from Schenectady to the Boston & Maine Railroad bridge at Rotterdam Junction. The company plans to build a railway connecting its Schenectady plant with Rotterdam Junction so as to make a direct connection with the Boston & Maine Railroad and the West Shore Railroad.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., announces the resignation of B. A. Plimpton, sales manager, effective Aug. 15. For the present his duties will be taken over by D. H. Osborne, acting sales manager at Victor, N. Y.

Supply Jobbers' Notes

THE WESTINGHOUSE AGENT-JOBBERS' ASSOCIATION held a meeting at Hot Springs, Va., from July 26 to 29, which was attended by approximately 100 members of the associated members and Westinghouse officials and representatives. At the business meetings plans for improving merchandising methods were discussed and the value of advertising and its relation to merchandising was clearly emphasized. Although much time was given to entertainment during the afternoon, important business problems were discussed during the morning and evening sessions. F. E. Stow, treasurer and general manager of the H. C. Roberts Electric Supply Company, Philadelphia, was re-elected president; J. J. Gibson, manager of the supply department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., was elected vice president. C. C. Blackwell, secretary, and J. E. McCleron, treasurer, were re-elected.

Foreign Trade Notes

GERMAN OVERSEAS ELECTRIC COMPANY ACQUIRED BY SPANISH INTERESTS.—Through the American Embassy at Madrid it is learned that the control of the German Overseas Electric Company, commonly known in the United States as the D. U. E. G., has passed into Spanish hands through the acquisition of its outstanding claims by representatives of the banks of Madrid, Barcelona and Bilboa. The transfer of the assets of the company was unanimously voted at a special meeting of the stockholders held in Berlin June 7. The Spanish bankers will transfer the assets of the German company to a Span-

ish society which, it is understood, will be formed in Madrid soon with a capital stock of 120,000,000 pesetas in shares, 180,000,000 in bonds and probably 25,000,000 in "obligaciones." The company controls electric light plants and street railway systems in Argentina and Chile, South America.

SWISS ELECTRICAL IMPORTERS.—A list of importers of electrical and household appliances in Switzerland has been prepared by the United States Bureau of Foreign and Domestic Commerce. The list may be obtained from the bureau or its district and co-operative offices by reference to file No. Eur.-13,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An official of a state government in Mexico (No. 33,417) desires to purchase 500 rolls of telegraph wire, 500 rolls of telephone wire, 30,000 wooden dowels, 15,000 telegraph insulators, 15,000 telephone insulators, 1,000 kilos of 2 in. nails for dowels and 5,000 kilos of sulphate of copper.

A firm of mechanical and electrical engineers in India (No. 33,421) desires to receive quotations from manufacturers on a large number of motors and generating sets.

A general merchant in China (No. 33 440) desires to secure the representation of firms for the sale of electrical goods, etc.

A commercial agent in Spain (No. 33,547) desires to purchase and secure an agency for the sale of electrical material, etc.

A firm of merchants and commission agents in India (No. 33,462) desires to secure agencies for the sale of electrical goods, etc.

A hardware merchant in Mexico (No. 33,463) desires to purchase electric flashlights and batteries, etc.

Trade Publications

GLASS INSULATORS.—The Hemingray Company, Covington, Ky., is circulating catalog No. 31, entitled "Hemingray."

ELEVATOR CONTROLLERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a twenty-four page booklet entitled "Elevator Controller," known as publication 840.

HEATING, VENTILATING AND HUMIDIFYING.—The Buffalo Forge Company, Buffalo, N. Y., has issued catalog No. 700, entitled "Buffalo Fan System of Heating, Ventilating and Humidifying." The book contains 115 pages and gives engineering data and developments.

METAL REFLECTORS.—The Ivanhoe-Regent Works of the General Electric Company, Cleveland, Ohio, has issued catalog No. 320, covering the "Ivanhoe" metal reflectors and fittings for industrial illumination.

PLUGS AND RECEPTACLES.—The Albert & J. M. Anderson Manufacturing Company, Boston, has issued bulletin No. 34, describing its "A. B. C." plugs and receptacles, and bulletin No. 35, covering the Anderson charging plugs and receptacles.

HEADLIGHT EQUIPMENT.—"Keystone Locomotive Headlight Equipment" is the title of Bulletin No. 166, published by the Electric Service Supplies Company, Philadelphia.

ILLUMINATION.—"Lighting for Eye Comfort," serial 283, is being issued by the National X-Ray Reflector Company, Chicago, Ill., along with serial plates, numbered 53 to 56.

SCIENTIFIC INSTRUMENTS. — The Standard Scientific Company, 147-153 Waverly Place, New York City, is distributing its 1920 catalog, covering its scientific instruments and laboratory supplies, etc.

FARM-LIGHTING PLANTS.—The Delco Light Company is circulating three booklets, entitled "Delco-Light Electricity," "The Delco-Light-Water System" and "Delco-Light."

ELECTRODES. — The National Carbon Company, 30 East Forty-second Street, New York City, has published a booklet entitled "The Carbon Electrode."

PORTABLE CRANES AND HOISTS.—"The Handiest Tool in the Shop" is the title of a booklet published by the Canton Foundry & Machine Company, Canton, Ohio.

New Incorporations

THE NORTH WISCONSIN HYDRO-ELECTRIC POWER COMPANY, Port Wing, Wis., has been incorporated with a capital stock of $100,000 to construct a hydro-electric power plant at Orienta Falls on Iron River. T. N. Ekerstrom is president of the company .

THE AUTOMATIC LIGHT SWITCH COMPANY, Louisville, Ky., has been incorporated with a capital stock of $50,000 to manufacture electrical switches and other kindred supplies. The incorporators are J. W. Roberts, C. I. Pickrell and W. L. Scott.

THE ART DISPLAY LIGHTING COMPANY, New York City, has been incorporated by M. M. Mittlemark, A. W. Jenkins and G. Singer, 2683 Briggs Avenue, New York City. The company is capitalized at 25,000 and proposes to manufacture electric lighting novelties, etc.

THE TRAVER-BLAIR COMPANY, Oneonta, N. Y., has been incorporated by W. J. Blair, B. A. and A. Traver, 318 West Twenty-fifth Street, New York City. The company is capitalized at $100,000 and proposes to manufacture motors and electrical machinery.

THE IVINS-LAMBORN ELECTRIC COMPANY, West Chester, Pa., has been incorporated with a capital stock of $25,000 to manufacture electrical appliances and devices. Walter S. Grosh is treasurer.

New England States

BRUNSWICK, ME.—The erection of an electric light plant at Bowdoin College, to cost about $25,000, has been arranged for by the board of directors of the institution.

SACO, ME.—The Garland Manufacturing Company contemplates electrical operation of its factory in place of the steam operation now in use. Motors, other machinery and apparatus will be required.

RUTLAND, VT.—At a recent meeting the Vermont Public Service Commission decided to grant the request of petitioners to form a public utilities corporation for the purpose of furnishing light and power for cottages on Lake St. Catherine.

WOODSTOCK, VT. — The Maplewood Lumber Company contemplates the construction of an addition to its power house.

BOSTON, MASS.—The Washington-Essex Building Trustees, 723 Scollay Building, has awarded contract to George B. H. Macomber, 44 Bromfield Street, for the construction of a theater to cost about $1,500,000. Electric lighting equipment will be required.

CAMBRIDGE, MASS.—Plans are under way for the construction of a power house, 20 ft. x 40 ft., for the A. R. Hyde Company, 432 Columbia Street. James A. Tuck, 34 School Street, Boston, is architect.

LAWRENCE, MASS.—Preliminary plans are under way by the Lawrence Gas Company for the establishment of a "white-way" street-lighting system along Essex Street and Broadway.

NORTHAMPTON, MASS. — The Nonotuck Silk Company has plans under way for the erection of a substation at its mills.

PITTSFIELD, MASS.—During the next five years the Pittsfield Electric Company contemplates an expenditure of $1,000,000 for additions to its power plants and lines, and of that amount the company plans to spend $400,000 within the next year.

WORCESTER, MASS. — H. W. Trulson, 35 Berksmans Street, will soon award the contract for the construction of a garage to cost about $150,000. Electric light and power equipment will be installed.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

PAWTUCKET, R. I.—The Tubular Woven Fabric Company contemplates the installation of electrical equipment to include thirty-eight motors from 2 hp. to 25 hp., transformers, new lighting arrangement, wiring, etc. The present voltage will be changed from 220 to 550.

BRISTOL, CONN.—Bids will soon be received by the Board of Education for the erection of a high school to cost about $750,000. Wilson Potter, 22 East Seventeenth Street, New York, N. Y., is architect.

NEW BRITAIN, CONN.—Contract has been awarded to the Collins-Lotz Company of Hartford by the Hart & Hutchinson Company, Corbin Avenue, New Britain, for the construction of a power plant at its metal works, to be used in connection with a factory addition to be erected.

NEW HAVEN, CONN. — Contract will soon be awarded by the Yale University for the erection of a dormitory building to cost about $400,000. Electric light equipment will be installed.

WEST HARTFORD, CONN. — Bids will be received by the Board of Education until Sept. 1 for the erection of a high school to cost about $500,000. Electric light equipment will be installed. W. T. Marchant, 36 Pearl Street, Hartford, is architect.

Middle Atlantic States

BATAVIA, N. Y. — The Public Service Commission has granted permission to the Genesee Light & Power Company to issue $56,700 in stock to be used for new construction and equipment at its power plant and for improvements to its distribution system.

HINCKLEY, N. Y.—The Oswego Falls Pulp & Paper Company of Fulton is considering plans for the erection of a new power house for works service at its plant at Hinckley.

NEW YORK, N. Y.—The United Zinc Smelting Corporation, 233 Broadway, plans to install a 250-kw. generating unit, two 100-hp. motors for fans, two 20-hp. motors for kiln, three 10-hp. elevator motors, etc.

SYRACUSE, N. Y.—Plans are under way for the erection of a power plant on Free Street to cost about $60,000 for the Jones Oil Engine Company, 227 Walton Street.

BAYONNE, N. J.—The installation of an ornamental street-lighting system on Avenue C was discussed at a recent meeting of the Avenue C Merchants' and Taxpayers' Association, and it was decided to put the matter before the City Commissioners.

CAPE MAY, N. J.—The City Commissioners contemplate the establishment of a municipal electric light and power plant.

DOVER, N. J.—Arrangements have been made between the Board of Water Commissioners and the New Jersey Gas & Electric Company for the installation of new electrical pumping machinery at the local waterworks.

EAST ORANGE, N. J.—The lighting committee of the City Council, Joseph M. Brown chairman, is negotiating with the Public Service Corporation for replacing the present street gas lamps with improved electric lamps.

HACKENSACK, N. J.—Plans are under way by the building committee of the Hackensack General Hospital, Third Street, for the construction of a power house at the institution to cost about $40,000. Crow, Lewis & Wick, 200 Fifth Avenue, New York, N. Y., are architects.

PASSAIC, N. J.—An Uptown Merchants' Association is being formed for the purpose of installing an ornamental street-lighting system in Passaic.

PERTH AMBOY, N. J.—Extensions and improvements to the fire-alarm and police-alarm systems in various parts of the city are contemplated. Jay B. Franke is city electrician.

POINT PLEASANT, N. J. — Bids are being received by the Lakewood & Coast Electric Company for furnishing material for the erection of a 13,200-volt, three-phase, three-wire transmission line from Point Pleasant to Seaside Heights, a distance of 15 miles. S. W. Borden at Summit is general manager.

TRENTON, N. J.—New bids will be received by the City Commission for one 25,000,000-gal. pump and one 1,000-hp. steam turbine-driven generator for the municipal waterworks.

WEST ORANGE, N. J.—Bids will be received by the Thomas A. Edison Company, Lakeside Avenue, about Aug. 25 for the construction of an addition to the power house at its electrical plant, to cost $80,000, and about Sept. 1 for equipment to be installed. Lockwood, Green & Company, 101 Park Avenue, New York, N. Y., are engineers.

ELMHURST, PA. — The Greek Catholic Society of America has plans under way for the construction of an orphanage to cost about $350,000. Electric light equipment will be installed. Morris & MacHale, Burr Building, Scranton, are architects.

KITTANNING, PA.—The power house of the Kittanning Brick & Fire Company has been destroyed by fire, causing a loss of about $50,000. The plant, it is understood, will be rebuilt at once.

PHILADELPHIA, PA.—Bids will be received by William S. Twining, director, Department of City Transit, eleventh floor, 1211 Chestnut Street until Aug. 17 for furnishing about 800 gross tons of special 70-lb. conductor rail (contract No. 547) for the Frankford Elevated Railway.

PHILADELPHIA, PA.—The Pennsylvania Iron & Coal Company contemplates the erection of a power plant at North Philadelphia, to cost about $500,000.

PHILADELPHIA, PA.—The power plant of the Philadelphia Electric Company at Oak Lane has been destroyed by fire, causing a loss of about $20,000.

PHILADELPHIA, PA. — Contract has been awarded to T. Reilly, 1616 Thompson Street, by the Sacred Heart Convent, Mascher Street, for the construction of an addition to the power house at the institution to cost about $25,000.

PORT ALLEGANY, PA.—Bonds to the amount of $26,000 have been voted for the purpose of erecting and maintaining an electric lighting system in this borough.

READING, PA. — Dives, Pomeroy & Stewart, 600 Pennsylvania Street, have awarded contract to L. H. Focht & Sons, Inc., 529 Court Street, for the construction of a power house to cost about $45,000.

SUNBURY, PA.—Plans are under way by the Sunbury Trust & Safe Deposit, care of Verus T. Ritter, North American Building, Philadelphia, Pa., for the erection of a bank and office building to cost about $600,000. Electric light equipment will be required.

BALTIMORE, MD.—The West Construction Company, 907 American Building, has been awarded the contract by the Prest-O-Lite Company, Inc., 30 East Forty-second Street, New York, N. Y., for the construction of an acetylene plant at Violetville, to consist of eight buildings, at a cost of about $125,000. Electric light equipment will be installed.

INWOOD, W. VA.—The construction of an electric power plant in Inwood for industrial service is being planned by H. C. Musselman of Biglerville, Pa.

SPENCER, W. VA.—The plant of the Wieland Electric Company has been purchased by the Spencer Water & Ice Company. It is proposed to move the dynamos, engines, etc., from the Wieland company's power house to that of the Spencer company and to make additions of all necessary new and modern machinery.

NORFOLK, VA.—The Norfolk & Western Railway is planning for the installation of electric machinery at its piers at Lamberts Point. J. E. Crawford is chief engineer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Aug. 20, Hampton Roads, Va., Schedule 6620—generators; South Charleston, W. Va., Schedule 6641—motors and controllers; Portsmouth, Va., Schedule 6649—tubes and condenser. Until Aug. 31, Mare Island, Cal., Schedule 6633—electric cable. Until Sept. 3, Mare Island, Cal., or Brooklyn, N. Y., Schedule 6636—electric material. Applications for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Contract has been awarded to A. W. Kutsche, 623 Ford Building, by the Detroit Insulated Wire Company, Wesson and Albert Streets, for the construction of a factory and office building to cost about $80,000. Electric lights and motors will be installed.

DETROIT, MICH.—Contract will soon be awarded by the Zenith Carburetor Company, Hart Avenue, for the erection of a factory to cost about $70,000. Electric light and power equipment will be installed.

DETROIT, MICH.—William and Louis Berman, care of the Berman-Dwyer Realty Company, 1317 Dime Bank Building, contemplate the erection of an office building to cost about $500,000. Electric light and elevator equipment will be installed.

LAWTON, MICH. — The J. Hungerford Smith Company contemplates the erection of a power plant.

WARREN, OHIO.—The Board of Education has awarded contract to the Shustrump Company, Youngstown, for the erection of an addition to the West Technical High School, to cost $450,000, and an addition to the East Technical High School, to cost $400,000. Electric wiring and domestic science room equipment will be installed in each.

PALMYRA, ILL.—A certificate of convenience and necessity has been issued to the Palmyra Light, Heat & Power Company to extend its electric transmission line from a certain point on the Chicago, Peoria & St. Louis Railroad to Roher station to supply residents of that place.

PRINCETON, ILL.—An appropriation of $17,000 has been made for the purchase of a new unit to be installed in the municipal electric light plant, to develop 400 hp.

BROCKTON, ILL.—Plans are under way for the installation of a new electric street-lighting system in the city.

SPRINGFIELD, ILL. — Montgomery, Ward & Company, Chicago Avenue and Larrabee Street, Chicago, contemplate the construction of a power house at their local plant to cost about $20,000.

SPRINGFIELD, ILL.—The purchase of a condenser to be installed at the municipal electric plant to cost about $10,000 has been authorized by the City Council.

COLFAX, WIS. — The Colfax Light & Power Company has awarded contract to the St. Paul Electric Company, 145 East Fifth Street, St. Paul, Minn., for furnishing switchboard and motors to cost about $11,000.

CUDAHY, WIS. — The Worthington Pump & Machinery Company has received bids for the erection of a machine shop, 60 ft. x 170 ft. Electric motors will be installed.

GLENWOOD CITY, WIS.—Contract has been awarded by the Apple River Milling Company to the St. Paul Electric Company, 145 East Fifth Street, St. Paul, Minn., for furnishing transformers to be used in connection with the erection of a transmission line from Glenwood City to Emerald, a distance of about 10 miles.

MILWAUKEE, WIS. — The Columbia Rubber Mills, 176 Sixteenth Sreet, contemplate the erection of a factory and power house to cost about $75,000.

PESHTIGO, WIS.—The Peshtigo Pulp & Paper Company has awarded contract to the Jorgenson Construction Company, Denmark, for the construction of a hydro-electric power plant and dam, about 5 miles from Peshtigo. L. A. DeGuere, Grand Rapids, is engineer.

SHEYBOGAN, WIS. — The Sheybogan Clinic Association, Dr. W. Gunther, president, 902 North Eighth Street, has preliminary plans under way for the construction of a clinic building to cost about $100,000. Electric wiring and X-ray apparatus will be installed.

TWO RIVERS, WIS.—Bids will soon be received by the Board of Education for the erection of a high school and power house to cost about $400,000. John D. Chubb, Dearborn Street, Chicago, Ill., is architect.

ALBERT LEA, MINN.—The electric lighting plant of the Minnesota Gas & Electric Company, it is reported, has been recently destroyed by fire. Herbert L. Nichols is manager.

BEMIDJI, MINN.—A proposal has been submitted by the Minnesota Electric Light & Power Company to the City Council for the installation of an ornamental street-lighting system on the two main business streets at a cost of between $18,000 and $20,000.

FAIRMONT, MINN.—The Martin County Electric Service Company, Inc., has plans under way for the erection of 28 miles of transmission line from Fairmont to Dunnell, passing through Welcome and Ceylon, to cost about $28,000. W. E. Skinner, 3241 Aldrich Avenue, South Minneapolis, is engineer.

INDEPENDENCE, MINN.—At a recent village election it was voted to extend the electric transmission lines of the Wisconsin-Minnesota Light & Power Company, 178 Center Street, Winona, to Independence. Work will be started at once.

MILACA, MINN.—The city officials contemplate changing the municipal service from direct current to alternating current. A new generator will be installed.

DES MOINES, IOWA.—The State Board of Commissioners, Capitol Building, will soon receive bids for the construction of a power plant to cost about $200,000. The Canfield Engineering Company, Flynn Building, is engineer.

GRANT, IOWA.—A special election for the purpose of voting bonds for an electric light plant in Grant is under consideration.

ST. LOUIS, MO.—The Swift Company of Chicago has had plans prepared for the construction of an addition to its power plant at St. Louis to cost about $100,000.

ST. LOUIS, MO. — Contract has been awarded to Joseph Stewart & Son, Boatman's Bank Building, by the Davis Rankin Junior School, 4431 Finney Street, for the erection of an addition to its power house to cost about $15,000. Eames & Young, Arcade Building, are architects.

WENTZVILLE, MO.—The erection of an electric light and power plant to cost about $30,000 is contemplated by the city officials. E. T. Archer & Company, 609 New England Building, Kansas City, are architects.

SIOUX FALLS, S. D.—Improvements to the electric lighting system to cost about $175,000 are contemplated.

Southern States

MONOCURE, N. C. — The Monocure Manufacturing Company, recently organized with a capital of $200,000, contemplates the development of water power on the Deep River for the purpose of furnishing electricity to Monocure, Pittsboro and other places.

PILOT MOUNTAIN, N. C.—Surveys are being made of the Ararat River near Pilot Mountain with the view of constructing a power plant and dam.

ENGLEWOOD, TENN. — The Eureka Cotton Mills, J. L. Ferguson, treasurer and manager, contemplate complete electrification of their plant.

HUNTSVILLE, ALA. — The Margaret Mills are planning for the electrification of their entire plant. T. B. Reynolds is superintendent.

CLEVELAND, MISS.—Notice of an increase in its capital stock from $10,000 to $40,000 has been filed by the Home Light & Ice Company for extensions to its electric light plant.

LITTLE ROCK, ARK.—The Dixie Power Company, Walter Powell president, has applied to Congress for approval of the erection of a dam 200 ft. high, across the White River for power purposes. Henry A. Allen, Chicago, Ill., is engineer.

SPRINGDALE, ARK.—The local electric light and power plant has been purchased by Goss & Early of Fayetteville, who contemplate improving and remodeling it.

AMARILLO, TEX.—The Electric plant of the Amarillo Gas & Electric Company has been destroyed by fire, causing a loss of about $100,000. Repairs will be made and new electric generating equipment installed at once.

MEMPHIS, TEX. — The plant of the Texas Gas & Electric Company was recently destroyed by fire, causing a loss of about $75,000. The plant will be rebuilt and new machinery installed at once.

Pacific and Mountain States

SEATTLE, WASH.—The Puget Sound Power & Light Company has applied for a fifty-year franchise to extend its transmission lines into new territory covering thirty roads in Whatcom County, Washington.

PORTLAND, ORE.—Plans are being prepared by E. Kroner, architect, Worcester Building, for the erection of a nurses' home, power plant and laundry at the Emanuel Hospital, Stanton and Commercial Streets, to cost about $75,000.

KLINK, CAL.—The local substation of the Southern California Edison Company, it is reported, has been destroyed by fire.

LONG BEACH, CAL.—Plans are under way for the installation of a lighting system on Ocean Boulevard. Standards will be placed on both sides of the street from Alamitos Avenue to Termino Avenue.

LOS ANGELES, CAL.—The Los Angeles Railway Company contemplates an expenditure of $150,000 for improvements. Plans include the overhauling and replacing of the three existing transformers at the Plaza substation and the installation of two new 15,000-kw. transformers. Other equipment will be installed at Avenue 28 and Huron Street.

OGDEN, UTAH.—The City officials are considering the calling of a special election for the purpose of submitting to the voters a proposal to issue bonds for the erection of a municipal light plant and water system.

PHOENIX, ARIZ.—Plans are under way by the Paradise-Verde Irrigation District of Phoenix for the erection of a power plant on the Verde River to cost between $16,000,000 and $20,000,000.

DENVER, COL.—The extensive program of the Mountain States Telegraph & Telephone Company provides for an appropriation of $7,500,000 for new exchanges, toll and local lines and equipment in the Rocky Mountain States, covering a construction period of five years.

DENVER, COL.—The Mountain States Telegraph & Telephone Company will erect an office and exchange building to cost about $350,000. Automatic switchboards will be installed.

DENVER, COL.—Bids will be received by the school board of the city and county of Denver until Sept. 15 for the construction of a school to cost about $420,000. Electric motors will be installed. W. N. Bowman, Central Savings Bank Building, is architect.

DEMING, N. M.—Plans are under way for the establishment of a power plant capable of developing 22,000 hp. at Elephant Butte dam. The cost of the project is estimated at about $4,000,000.

Record of Electrical Patents

Notes on United States Patents

(Issued July 27, 1920)

1,347,495. AUTOMOBILE ALARM; George M. Campbell, St. Louis, Mo. App. filed July 28, 1919. Theft alarm.

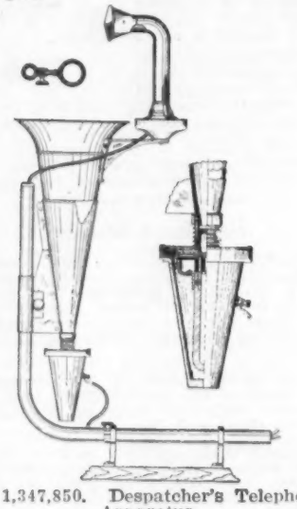
1,347,511. IGNITION SYSTEM; William O. Kennington, London, England. App. filed Sept. 21, 1918. For preventing ignition upon the reverse rotation of the engine.

1,347,546. ELECTRIC SYSTEM; Everett P. Larsh, Dayton, Ohio. App. filed June 21, 1915. Automatic generating system.

1,347,577. SWIVEL-PLUG CONNECTOR; Edward DeWald, Sr., Cincinnati, Ohio. App. filed Dec. 26, 1919. Edison base plug.

1,347,580. PRINTING TELEGRAPH; George S. Hiltz, Brooklyn, N. Y. App. filed Oct. 24, 1918. Utilizing three current strengths.

1,347,584. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Feb. 14, 1917. For private branch exchanges.



No. 1,347,850. Despatcher's Telephone Apparatus

1,347,588. ELECTRIC STORAGE BATTERY; Frederick W. Radell, Glenside, Pa. App. filed Dec. 27, 1919. Separator rearrangement.

1,347,590. ELECTRICAL CONNECTOR; Maxwell W. Robertson, Belle Harbor, N. Y. App. filed Nov. 19, 1917. Clamped in recess in brush.

1,347,647. DYNAMO-ELECTRIC MACHINERY; John H. St.H. Mawdsley, Dursley, England. App. filed March 12, 1917. One interpole per pair of main poles.

1,347,710. SANITARY TELEPHONE ATTACHMENT; Ellis M. Potter, New York, N. Y. App. filed July 28, 1919. Detachable disinfecting guard.

1,347,715. SELECTIVE CONTROL SYSTEM; Axel U. Särnmark, Stockholm, Sweden. App. filed Sept. 9, 1916. For telegraph typewriting.

1,347,718. IGNITING DEVICE; Carl H. Shuford, Dallas, Tex. App. filed Feb. 7, 1919. For gas burner.

1,347,738. CURRENT-CARRYING PLUG; Harry A. Douglas, Bronson, Mich. App. filed Oct. 14, 1917. Spring-held butt contacts.

1,347,751. CONTROL OF INDUCTION MOTORS; Robert H. McLain, Schenectady, N. Y. App. filed Nov. 21, 1917. Speed variations.

1,347,760. MOTOR-CONTROL SYSTEM; Claude C. Runner, Schenectady, N. Y. App. filed March 14, 1918. Low-current actuated contactors.

1,347,767. OVERLOAD RELAY; Eugene E. Valk, Los Angeles, Cal. App. filed Nov. 21, 1917. Excitation control.

1,347,769. CASING FOR ELECTRICAL APPARATUS; James Wilkinson, Schenectady, N. Y. App. filed Oct. 29, 1917. Pneumatically supported column of oil reaching the top of the casing.

1,347,770. ACCUMULATOR ELECTRODE GRID; Sigmund Willner, London, England. App. filed Sept. 4, 1918. Bar construction.

1,347,772. PROTECTIVE MEANS FOR SYSTEMS OF DISTRIBUTION; David Basch, Schenectady, N. Y. App. filed Sept. 12, 1917. For protection of parallel feeders.

1,347,776. ELECTRODE HOLDER; Ralph H. Chadwick, Fort Wayne, Ind. App. filed Sept. 23, 1919. For holding hand-manipulated carbon electrodes.

1,347,781. CONTROL OF ELECTRIC MOTORS; Benjamin W. Jones, Schenectady, N. Y. App. filed May 20, 1918. Automatically controlled starting resistance.

1,347,783. ALTERNATING-CURRENT MOTOR; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed April 30, 1918. Nine-phase.

1,347,832. ELECTRODE FOR SECONDARY OR STORAGE BATTERIES; James M. Allen, St. Louis, Mo. App. filed Aug. 18, 1919. Specially shaped plates.

1,347,838. METHOD OF TREATING METALS; Reginald H. Bulley, Syracuse, N. Y. App. filed April 24, 1916. Heroult type.

1,347,849. SIGNALING CIRCUIT; Paul J. Hackett, Seattle, Wash. App. filed June 21, 1919. Two-way communication.

1,347,850. DESPATCHER'S TELEPHONE APPARATUS; Paul J. Hackett, Seattle, Wash. App. filed July 3, 1919. Loud-speaking.

1,347,863. MOTOR CONTROLLER; Wilmar F. Lent, New York, N. Y. App. filed June 21, 1916. Drifting prevention.

1,347,873. BATTERY GRID; Paul B. Rabe, Chicago, Ill. App. filed April 30, 1919. Paste retained by tapering walls.

1,347,879. CONTROL FOR EXPLOSION-PROOF ELECTRICAL APPARATUS; Charles W. Starker, Pittsburgh, Pa. App. filed Feb. 8, 1918. Located within motor casing.

1,347,880. CONTROL APPARATUS; Charles C. Whittaker, Wilkinsburg, Pa. App. filed Dec. 2, 1916. Liquid rheostat.

1,347,894. VACUUM-TYPE INVERTED CONVERTER; Lewis W. Chubb, Edgewood Park, Pa. App. filed Nov. 29, 1915. High voltage.

1,347,895. ELECTRIC FURNACE FOR HEATING RIBBONS AND BARS; Ora A. Colby, Larimer, Pa. App. filed Sept. 16, 1918. Continous heating.

1,347,896. DOUBLE HOT-CHAMBER FURNACE; Ora A. Colby, Irwin, Pa. App. filed Dec. 14, 1918. Electric resistance furnace.

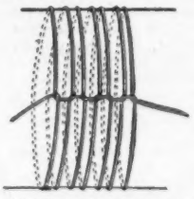
1,347,900. RESISTANCE UNIT; Carl R. Englund, East Orange, N. J. App. filed April 18, 1919. Substantially non-reactive.

1,347,903. SYSTEM OF CONTROL FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 4, 1916. Acceleration of alternating-current commutator motors of the compensated type.

1,347,904. REGENERATIVE CONTROL FOR ALTERNATING-CURRENT COMMUTATOR MOTORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Jan. 10, 1917. Drooping-voltage characteristic.

1,347,905. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed March 9, 1917. Regeneration to zero speed.

1,347,908. AUTOMATIC CIRCUIT INTERRUPTING DEVICE; Arthur du Pasquier, Hale, England. App. filed Dec. 1, 1916. For rolling-mill motors.



No. 1,347,900. Resistance Unit

1,347,910. TRANSFORMER FOR USE WITH ROTARY CONVERTERS; John F. Peters, Edgewood Park, Pa. App. filed April 29, 1915. Both high and low reactance.

1,347,970. WINDMILL-OPERATED GENERATOR; Frank A. Overstreet, Fort Summer, N. M. App. filed Oct. 7, 1916. Overloading prevented.

1,347,995. BED-WARMING DEVICE; Nathaniel W. Dendy, Asheville, N. C. App. filed Oct. 4, 1919. Easily and quickly regulated.

1,348,000. FORMATION TANK; David H. Fleming, Boston, Mass. App. filed April 7, 1920. To avoid danger of short-circuiting battery plates.

1,348,016. AUTOMATIC VALVE-CONTROLLING MEANS; Herman H. Lee, Brooklyn, N. Y. App. filed Jan. 31, 1919. Automatic control of steam pumps.

1,348,037. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, San Francisco, Cal. App. filed Nov. 24, 1916. Shunt member rotates against force of a spring.

1,348,052. CONTACT; Thomas B. Rider, Los Angeles, Cal. App. filed Feb. 9, 1918. Relay switch.

1,348,098. AUTOMATIC SWITCH; Carl W. Eisenmann, Nebraska City, Neb. App. filed June 16, 1916. For use in battery charging.

1,348,104. ELECTRIC SIDELIGHT; Richard S. Giese, Pittsburgh, Pa. App. filed Feb. 26, 1919. One-piece glass structure.

1,348,106. BRAKE; James T. Halsey, Philadelphia, Pa. App. filed Aug. 15, 1913. Susceptible of gradual application.

1,348,128. ELECTRICAL CONNECTION; John H. George, Bridgeport, Conn. App. filed June 17, 1918. To connect and disconnect battery terminals.

14,927 (reissue). APPARATUS FOR ELECTRIC WELDING; Frank L. Sessions, Lakewood Ohio. App. filed May 5, 1919. Welding of juxtaposed edges.